

Overview



For full technical specifications, refer to AppleCare Tech Specs: <http://support.apple.com/specs/>

Battery Safety Precautions



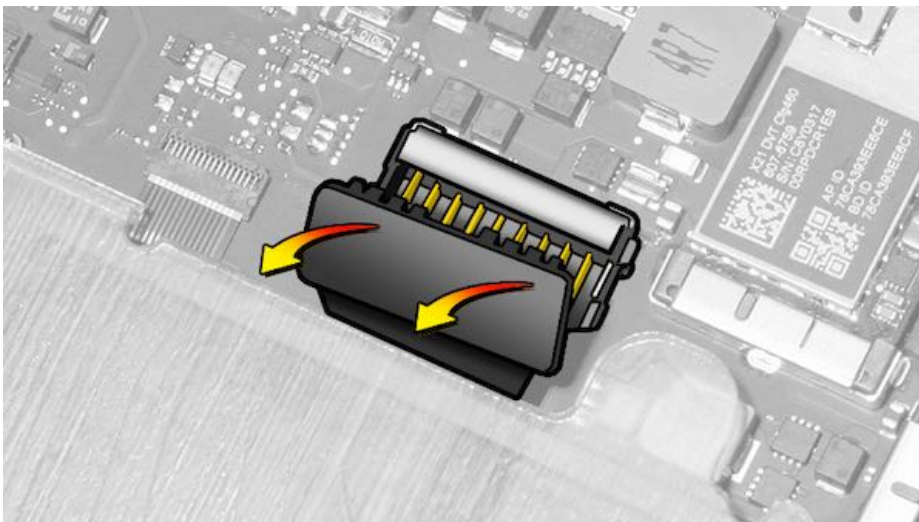
This computer contains a built-in Lithium-ion Polymer rechargeable battery pack that is serviceable by Apple Authorized Service Providers only. Tamper-resistant screws are employed to prevent users from attempting to remove the battery.

WARNING: Every time you remove the bottom case, attach the protective battery cover, and disconnect the battery cable from the logic board.

WARNING:

- Batteries must be handled with utmost care.
- All work space must be free of foreign or sharp material and batteries should not be exposed to heat or open flame.
- Do not drop, stack, puncture, crush, flex or apply unnecessary pressure to a battery, as this may result in damage.
- Damage to a battery may result in a potential fire hazard.

WARNING: Because the battery is built-in and connected to the logic board by a cable, it **MUST BE DISCONNECTED** before performing service procedures. If you fail to do so, live current from the battery will short circuit the components and render the logic board and/or the eDP cable unusable.



Handling and Storage

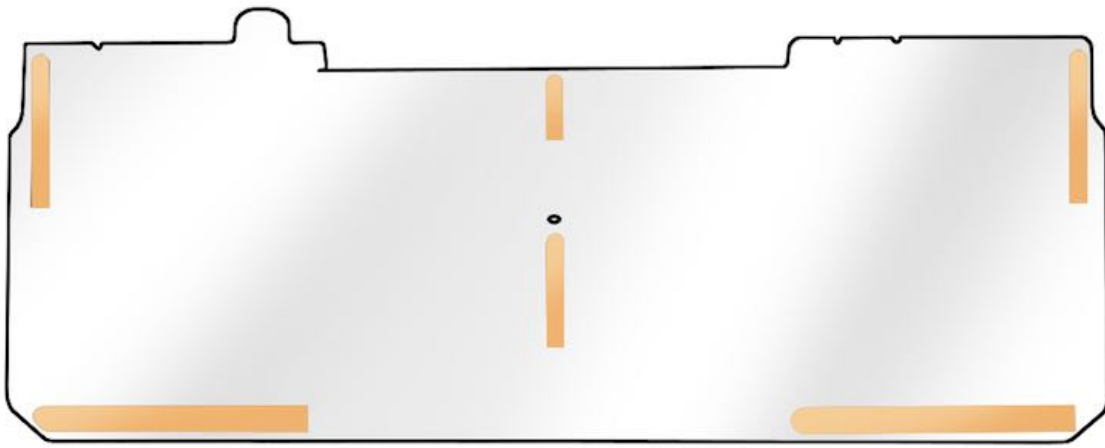
Best Practices

The battery contains several soft battery cells. Do not press on the battery cells with your fingers, and do not handle the battery pack in any way that might apply any physical pressure to these cells.

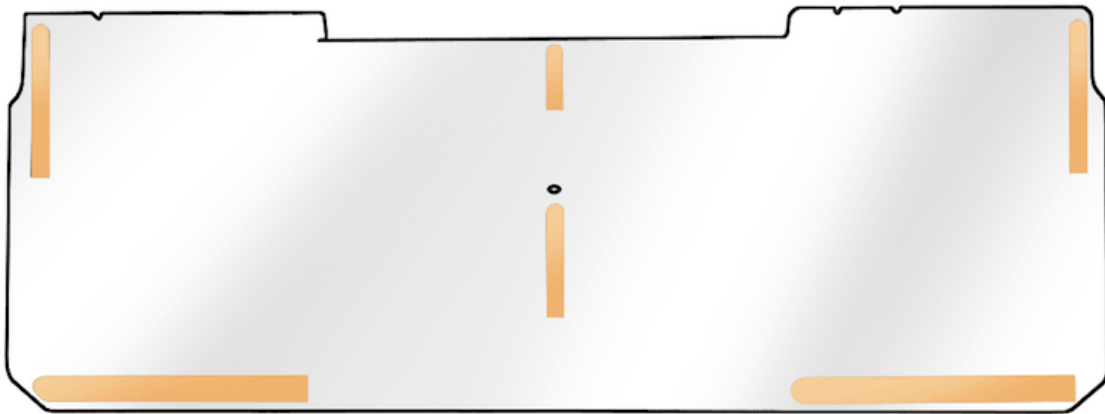
- Always attach the battery cover (922-9736) to the battery immediately after removing the bottom case and before beginning battery removal or any other repair.
- Handle the covered battery by its edges only, with two hands at all times.
- Keep the battery cover on the battery at all times when the battery is out of the computer.
- Only remove the battery cover just before replacing the computer's bottom case. Keep the battery cover on the battery at all other times.
- Do not drop a loose battery. If the battery is dropped, replace the battery.
- Only tighten the battery's screws finger tight; do not overtighten them by any amount, or irreparable damage to the battery pack can result.
- Do not twist or torque the battery, or irreparable damage to the battery can result.

Note: Two battery cover versions exist—one with a rounded tab at the top, and one without. The one without the tab is easier to use on the Mid 2011 model because it does not cover the battery connector. However, both cover versions can be used for any 11-inch model.

Late 2010



Mid 2011, Mid 2012, Mid 2013, Early 2014, Early 2015



Battery Inspection

Refer to article [OP693: MacBook Air \(Late 2010 and later\): Visual battery inspection](#) for the latest visual inspection details.

Proper Sequence For Battery Removal

Battery removal steps are mentioned below, however detailed battery removal and replacement steps are described in the [battery](#) take-apart chapter.

Important: When servicing the MacBook Air (11-inch) and MacBook Air (13-inch) computers, make sure you have a battery cover for each model, as the batteries are different sizes. Ensure a cover is placed on each battery whenever the bottom case is removed or if the battery is out of unit.

1. Remove the bottom case.
2. Attach battery cover onto the exposed side of battery while it is still installed inside the computer. **Note:** You can remove the cover by carefully pulling up on the top edge.
3. Disconnect battery connector from logic board.
4. Remove battery screws.
5. Carefully lift out covered battery with both hands and place on a smooth, hard, clean surface free of screws and other debris. Or, place battery in the box that the known-good battery shipped in.

Proper Sequence For Battery Replacement

Caution: Make sure no screws are stuck under the battery (inside the top case) or stuck to the inside cover of the bottom case. Check both areas before inserting battery and replacing bottom case.

1. Ensure battery cover is properly attached to the soft side of the battery before installing into computer. **Note:** The known-good battery should come with a cover already installed. Extra covers may be ordered in GSX.
2. Make sure top case interior is clean and free of any dust, dirt, loose screws, or other debris.
3. Carefully place known-good battery into position with both hands, aligning the screw holes in the battery frame with those of the computer's top case.
4. Use a torque driver, if available, to tighten battery screws to 1.8 +/- 0.18 Kgf-cm. Do not overtighten them by any amount or irreparable damage to the battery assembly can result.
5. Connect battery connector to logic board.
6. Before replacing bottom case, remove battery cover and inspect battery for any dust, dirt, loose screws, or other debris. Install bottom case from the front, and press lightly so that the internal clip snaps onto battery. The bottom case clip

7. can puncture a cell if the bottom case is installed incorrectly.

Personal Protection

Use utmost care when handling the battery. In general,

- Keep battery and computer away from heat and open flame. Store in a cool, dry place.
- When servicing the computer, use the battery cover as directed.
- When handling a large container of batteries, steel-toed shoes are recommended.

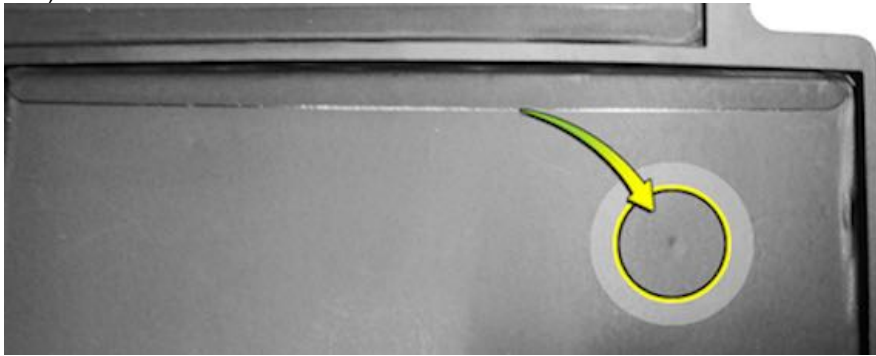
WARNING: For complete training on battery safety and first-aid measures in case of accidental exposure, **make sure you read and understand this article before servicing this computer:** [OP24: Safely Handling Lithium Ion and Lithium Polymer Batteries](#).

Evaluating Battery Damage

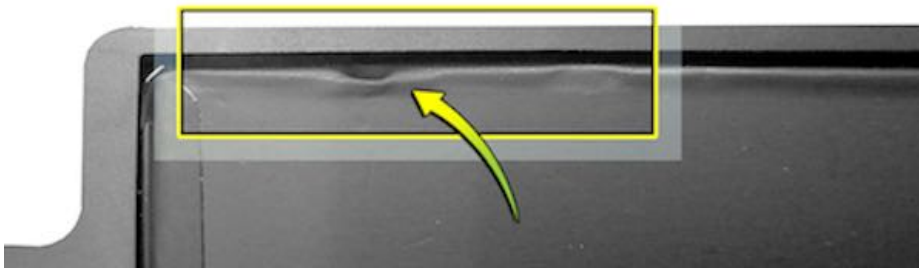
For more examples of cosmetic damage and directions on visual inspection, refer to article [OP693: MacBook Air \(Late 2010 and later\): Visual battery inspection](#).

Use battery if:

- Minor dents (up to eight dents if 0.4 mm deep or less; up to five if 1.5 mm deep or less; up to three if 2.0 mm deep or less)

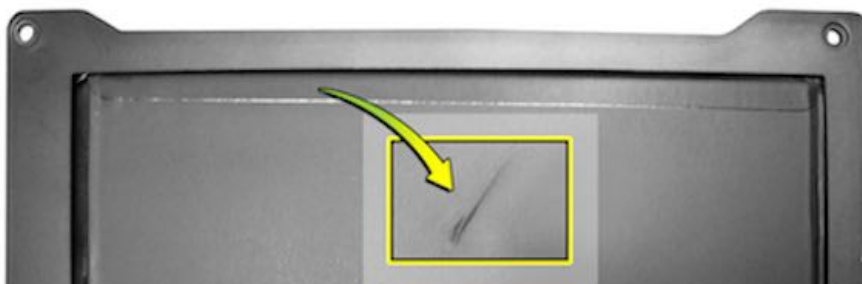


- Minor cell pack deformity (up to 2.0 mm total area)

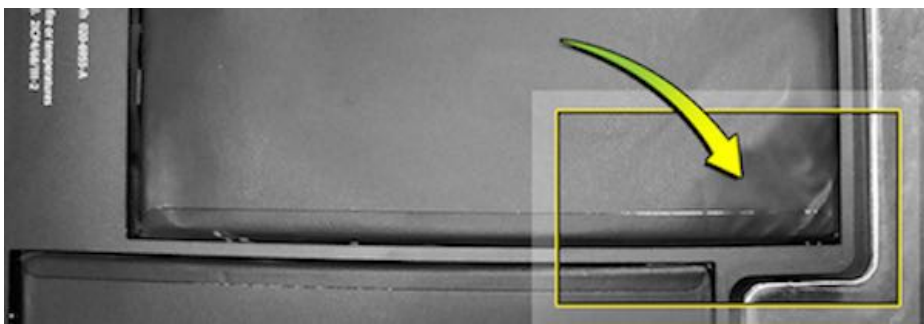


Return battery if

- Scratches



- Swollen or wrinkled cell pack



Thunderbolt

Thunderbolt is a revolutionary I/O technology that supports high-resolution displays and high-performance data devices through a single compact port. It sets new standards for speed, flexibility, and simplicity. Read more at <http://www.apple.com/thunderbolt>.

Important: Thunderbolt requires up-to-date software and firmware to function properly. Obtain the latest updates via Software Update.

Caution: The Thunderbolt port is keyed for cable insertion in only one direction. Be sure to insert cables with the correct orientation. Do not use excessive force if the cable does not fit.

Keycap Replacement

Topic

Service packages of replacement keycaps are available for MacBook Air (Mid 2011, Mid 2012, Mid 2013, Early 2014, and Early 2015) models. The packages allow you to replace individual keycaps rather than the entire top case.

The following instructions explain how to remove and replace a keycap and scissor mechanism (plastic piece under keycap that secures keycap to top case) on MacBook Air (Mid 2011 or later) models. If a keycap needs replacement due to accidental damage, such as a liquid spill, refer to [OP14: Determining and quoting accidental damage for Mac portables](#).

To help determine keyboard localization or keycap placement, refer to [HT201794: How to identify keyboard localizations](#).

Notes:

- Keycap kits are available for International English, U.S. English, and Japanese version keyboards.
- A European Special Character Kit is available with British (B), German (D), French (F), Danish (DK), Italian (T), Spanish (E), and Swedish (S) specific keycap characters.
 - **Note:** To receive the proper keycaps to complete a single British, German, French, Danish, Italian, Spanish or Swedish keyboard, order both the European Special Character Kit **and** the ISO English keycap kit. Neither kit by itself contains all the keycaps necessary for a single localized keyboard.
- Always shut down the computer before replacing a keycap.

Identifying Keycaps and Scissors

Different types of keycap packages are offered based on computer model and keyboard type (Versions D and S).

Part number	Computer Model	Keyboard	Languages supported
923-0064	MacBook Air (11-inch, Mid 2011 and later)	Version D	ANSI English
923-0065	MacBook Air (13-inch, Mid 2011 and later)	Version D	ANSI English
923-0130	MacBook Air (13-inch, Mid 2012 and later)	Version S	ANSI English
B923-0065	MacBook Air (13-inch, Mid 2011 and later)	Version D	ISO English
B923-0130	MacBook Air (13-inch, Mid 2012 and later)	Version S	ISO English
J923-0065	MacBook Air (13-inch, Mid 2011 and later)	Version D	Japanese
J923-0130	MacBook Air (13-inch, Mid 2012 and later)	Version S	Japanese
ZM923-0065	MacBook Air (13-inch, Mid 2011 and later)	Version D	European Special Character Kit
ZM923-0130	MacBook Air (13-inch, Mid 2011 and later)	Version S	European Special Character Kit

The MacBook Air (13-inch, Mid 2012 and later) uses Version D and Version S keyboards. The scissors for both versions D and S keyboards function the same, but have a slightly different design. Be sure to match only Version D keycaps to Version D scissors/keyboards and Version S keycaps to Version S scissors/keyboards.

The photos below identify Version D and Version S scissors.

Version D scissors



Version S scissors



Keycap Map

The following illustrations summarize the differences in removing keycaps on the MacBook Air (Mid 2011 and later) keyboards. For detailed instructions, see the **Procedure** section below.

MacBook Air (11-inch, Mid 2011 and later)



MacBook Air (13-inch, Mid 2011 and later)



- **Yellow:** No stabilizer bar under key cap
- **Orange:** Hooked stabilizer bar under key cap (two hooked bars under Space Bar)
- **Blue:** Straight stabilizer bar under key cap
- **Stripes:**
 - **No Stripes:** Lift key from the lower corners
 - **Stripes:** Lift key from the upper corners

Procedure

Use the following steps to remove a defective keycap and replace it with a new keycap and scissors from the service keycap package. When replacing a keycap replace the scissors below it.

Because the design of the keycap and scissor mechanism differs depending on the shape of the key, the procedure is divided into four parts:

1. **Square keys and small rectangular keys** (for example, letters A–Z, numbers, punctuation, function keys, and arrow keys). These use one scissor mechanism beneath the key.
2. **Large rectangular keys** (for example, Shift, Delete, Return). These use one or two scissor mechanisms and one stabilizer bar (no stabilizer bar on bottom row, rectangular keys).
3. **Space bar**. This uses two scissor mechanisms and two metal stabilizer bars.
4. **Top row keys**. This only applies to MacBook Air (11-inch, Mid 2011, Mid 2012). This uses no scissor mechanism and one hooked metal stabilizer bar.

Note on illustrations: Most of the steps are illustrated with Version D scissors. However, the steps are the same for Version S scissors except where indicated.

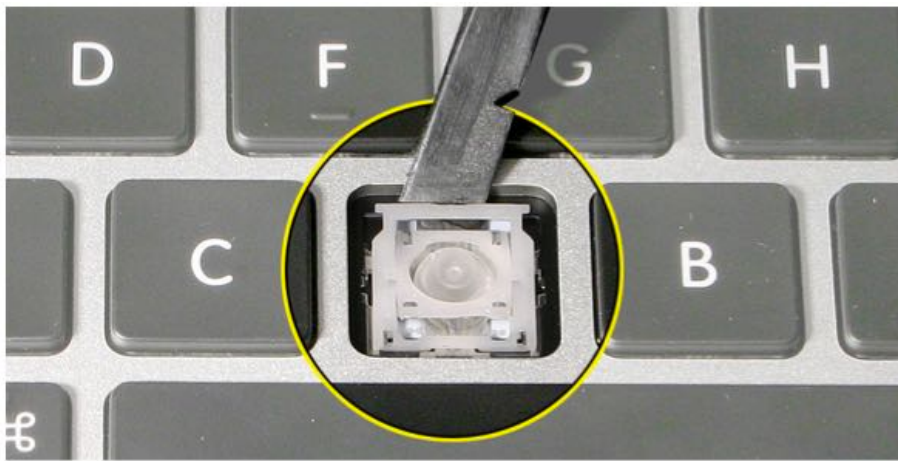
Important: Shut down the computer before replacing a keycap.

Removing and Replacing Square Keys and Small Rectangular Keys

1. Pry the key up from the lower edge—first at one corner and then at the other. Exception: Pry the Up Arrow keycap from the upper edge.

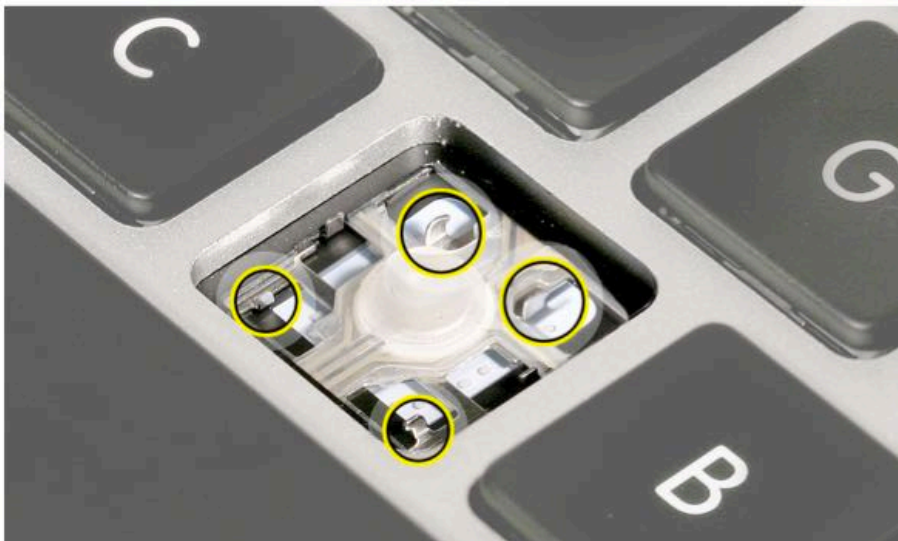


2. Pry and remove the scissor mechanism from the keycap well.



3. Check the rubber dome and raised metal areas inside the keycap well.

- When the rubber dome is pressed and released, it should spring back upright. If the rubber dome is off center or damaged, replace the top case.
- If the metal hook that holds the slider bar of the scissor mechanism is bent, try to bend it back to a uniform 90-degree angle. If it is bent or broken beyond repair, replace the top case.
- If the two metal ears are bent, use needle nose pliers to straighten them. If either or both ears are broken beyond repair, replace the top case.



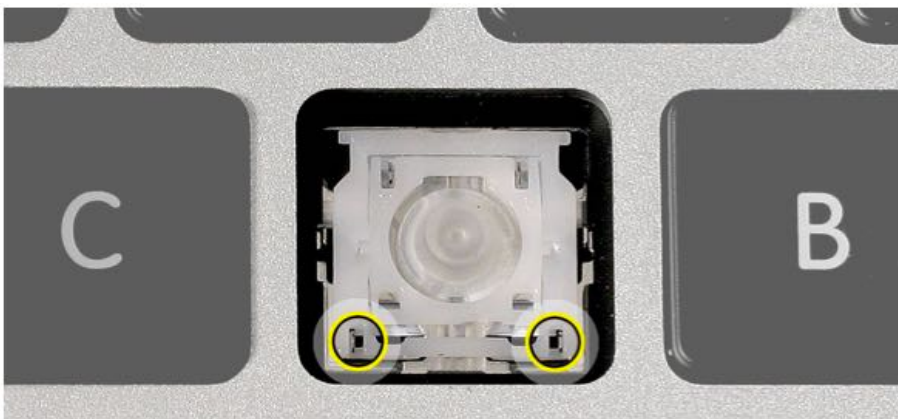
Note: To install the replacement scissor mechanism, you must first remove it from the replacement keycap.

4. Position the pointed end of a black stick under both plastic layers on the pin side of the scissors. Pry up and remove the scissors from the keycap.

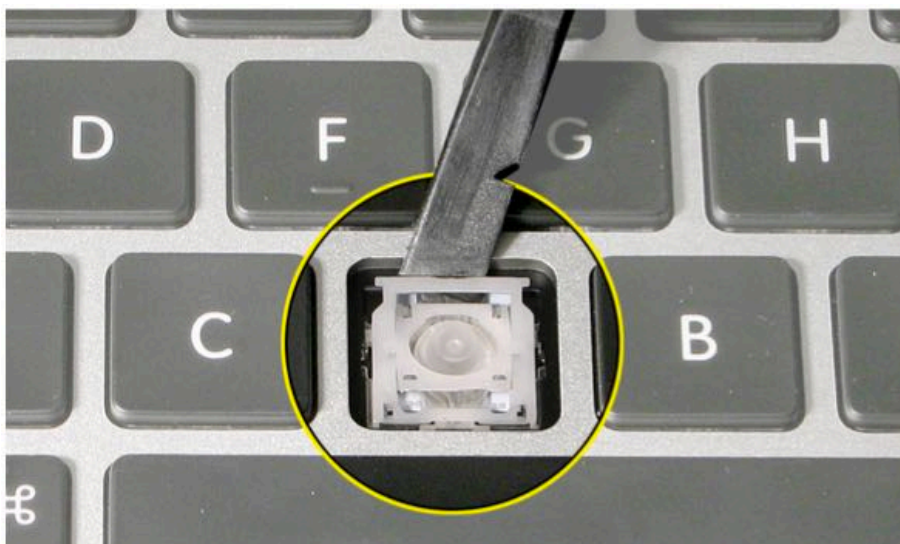


5. To install the replacement scissors in the keycap well, position the scissors so that the smooth side faces up. Holding the scissors closed, fit the two small square openings in the scissors onto the two metal hooks at the lower edge of the keycap well.

6. Press and slide the scissors up until the two rectangular openings in the scissors fit over the two metal hooks at the upper edge of the keycap well.



7. Use a black stick to raise and lower the scissor mechanism to make sure it moves freely.



8. Slide the upper edge of the keycap into the keycap well. Then press down on the top of the key until you feel it snap into place.



9. Check the key from all angles to make sure it is uniformly flat. Press and release the key repeatedly to verify that it springs back each time.

Removing and Replacing Large Rectangular Keys (except Space bar)

Note: All rectangular keys with a stabilizer bar use one hooked bar, with the exception of the Command key, which uses a straight bar.

1. Pry the Space bar from the lower two corners, and lift it a short distance.
2. Detach the stabilizer bar from the left and right openings in the two metal ears in the keycap well.



3. Remove the original scissors and install the replacement scissors. Refer to steps 2–6 under [Removing and Replacing Square Keys/Small Rectangular Keys](#).
4. With the stabilizer bar installed in the replacement keycap, rotate the stabilizer bar approximately 90 degrees out from the key. Then insert the ends of the bar into the openings in the metal ears in the keycap well.
5. Lower the key over the keycap well and press down on the top of the key until it snaps into place.
6. Check the key from all angles to make sure it is uniformly flat. Press and release the key repeatedly to verify that it springs back each time.

Removing and Replacing Space Bar

1. Pry the Space bar from the lower two corners, and lift it a short distance.



2. Using a black stick, separate the lower stabilizer bar from the keycap.



3. With the lower edge loosened, pry the Space bar from the upper edge. Use a black stick, if necessary, to tilt up and remove the keycap.

Note: To fully remove the keycap, you may need to pry it from the top stabilizer bar. Be sure to remove both stabilizer bars from the keycap well.

4. Remove the original scissors and install the replacement scissors. Refer to steps 2–7 under [Removing and Replacing Square Keys/Small Rectangular Keys](#).

Version D Space Bar Replacement

1. Orient the replacement Space bar so that the slider hooks on the underside of the key are at the lower edge of the key.

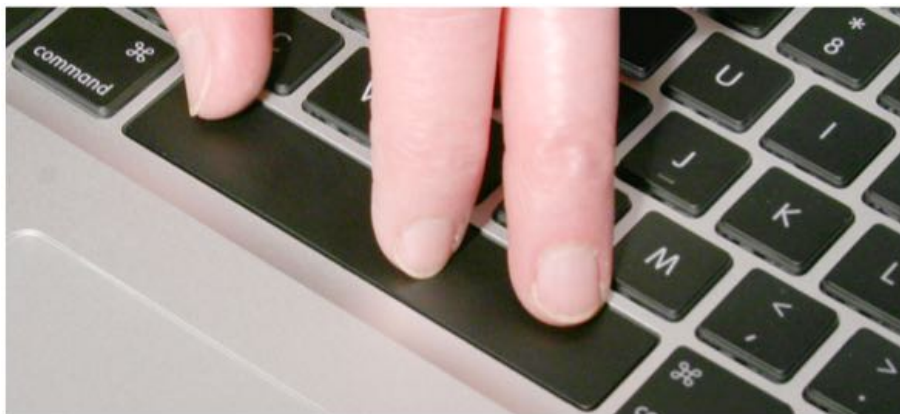


2. Rotate the lower stabilizer bar on the Space bar approximately 90 degrees out from the key and insert the ends of the bar into the two lower metal ears in the keycap well.



3. Insert the ends of the upper stabilizer bar into the two upper metal ears in the keycap well and lower the keycap over the well.

4. Press and slide your fingers along the Space bar until you hear the clips on the top and bottom edges snap into place.



5. Check the key from all angles to make sure it is uniformly flat. Press and release one corner of the key. If the key is installed correctly, the opposite corner should respond at the same level (not tilted higher or lower).

Version S Space Bar Replacement

1. Orient the replacement Space bar so that the slider hooks on the underside of the key are at the lower edge of the key.



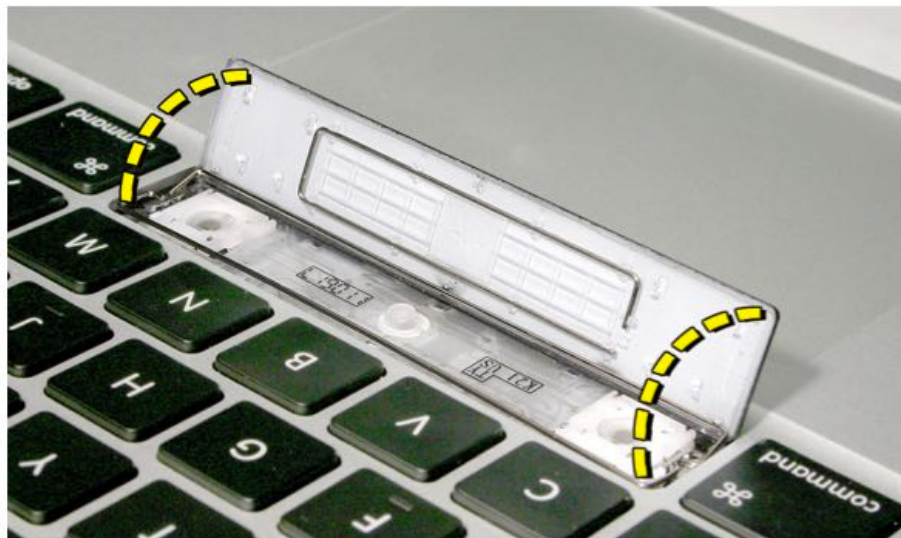
2. Using a black stick, remove the top stabilizer bar.



3. Hook the top stabilizer bar into the upper two metal ears in the keycap well.



4. Rotate the lower stabilizer bar on the Space bar approximately 90 degrees out from the key and hook the ends of the bar into the two lower metal ears in the keycap well.

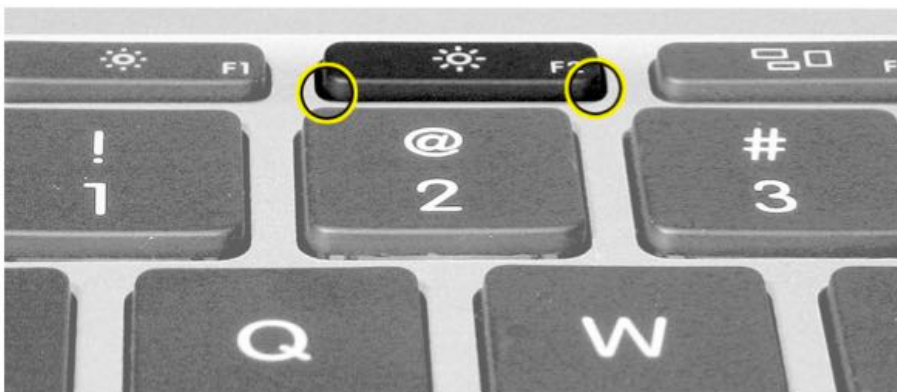


5. Lower the upper edge of the keycap down into the keycap well.

6. Press and slide your fingers along the Space bar until you hear the clips on the top and bottom edges snap into place.

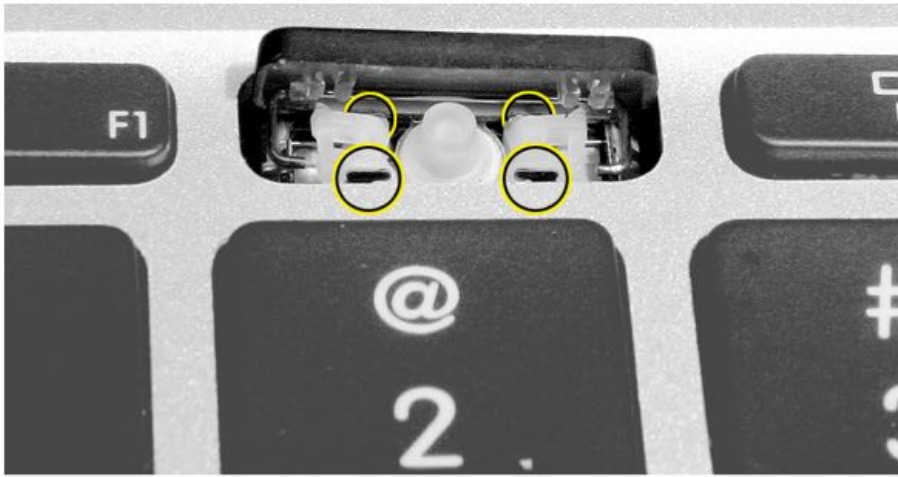
Removing and Replacing Top row keys

1. Remove a top row key by prying the bottom corners.

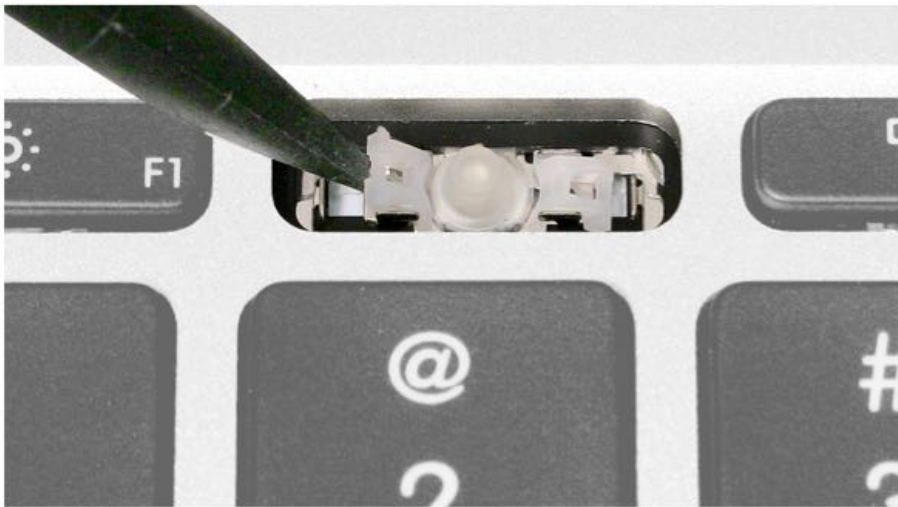


2. Check the rubber dome and raised metal hooks inside the keycap well.

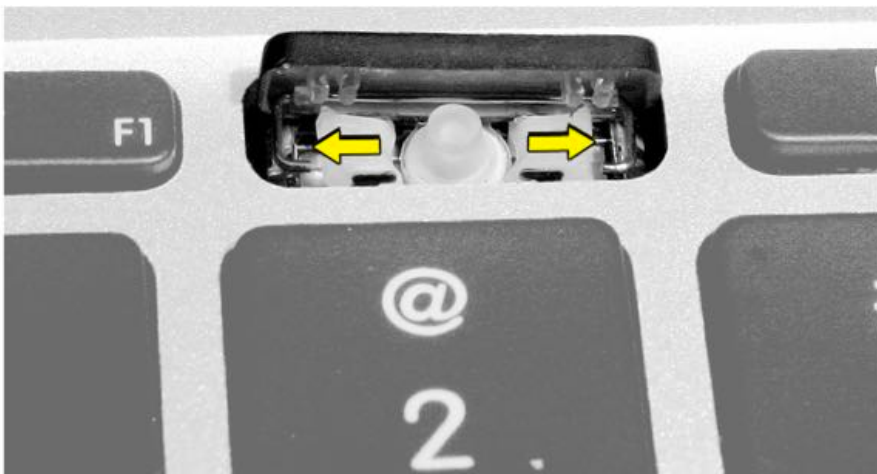
- When you press and release the rubber dome it should spring back upright. If the rubber dome is off center or damaged replace the top case.
- If any of the metal hooks that hold the plastic pieces are bent, try to bend them back to a uniform 90-degree angle. If they are bent or broken beyond repair, replace the top case.



3. Using the pointed tip of a black stick, remove the two plastic squares by tilting them up and sliding them toward the rubber dome.



4. To install the replacement squares in the keycap well, position them smooth side up, and lower them into the keycap well. Slide them away from the dome until the two metal hooks catch the plastic pins.



5. Press the stabilizer bar into the two clips inside the top of the keycap.



6. Fold the stabilizer bar flush inside the keycap.

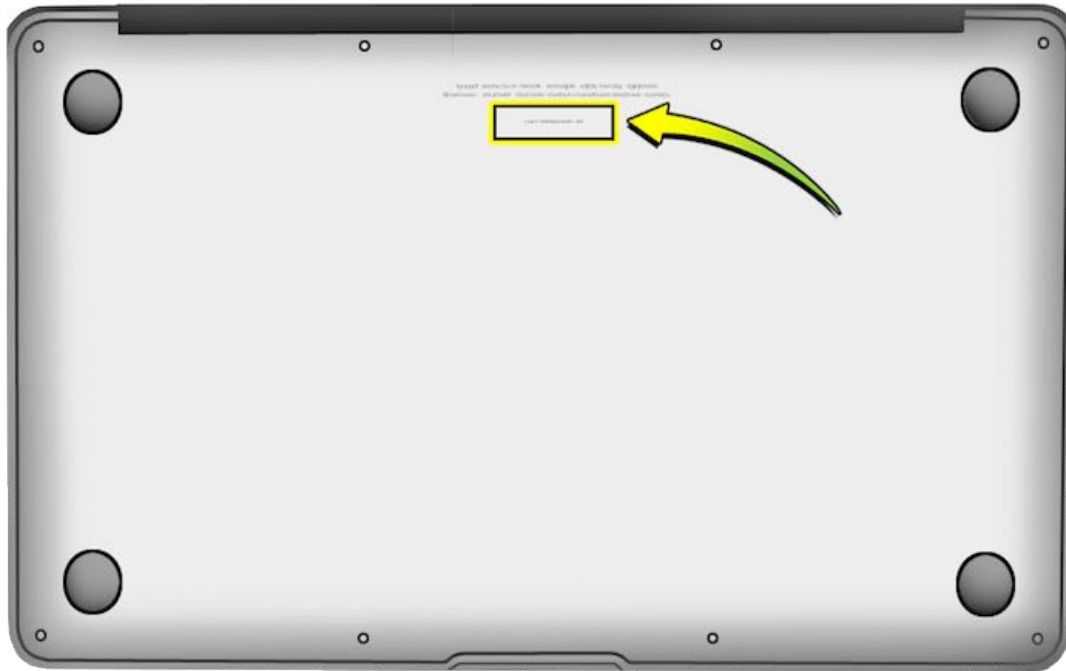
7. Center the keycap into the keycap well, and then press down on the top of the key until you feel it snap in place.



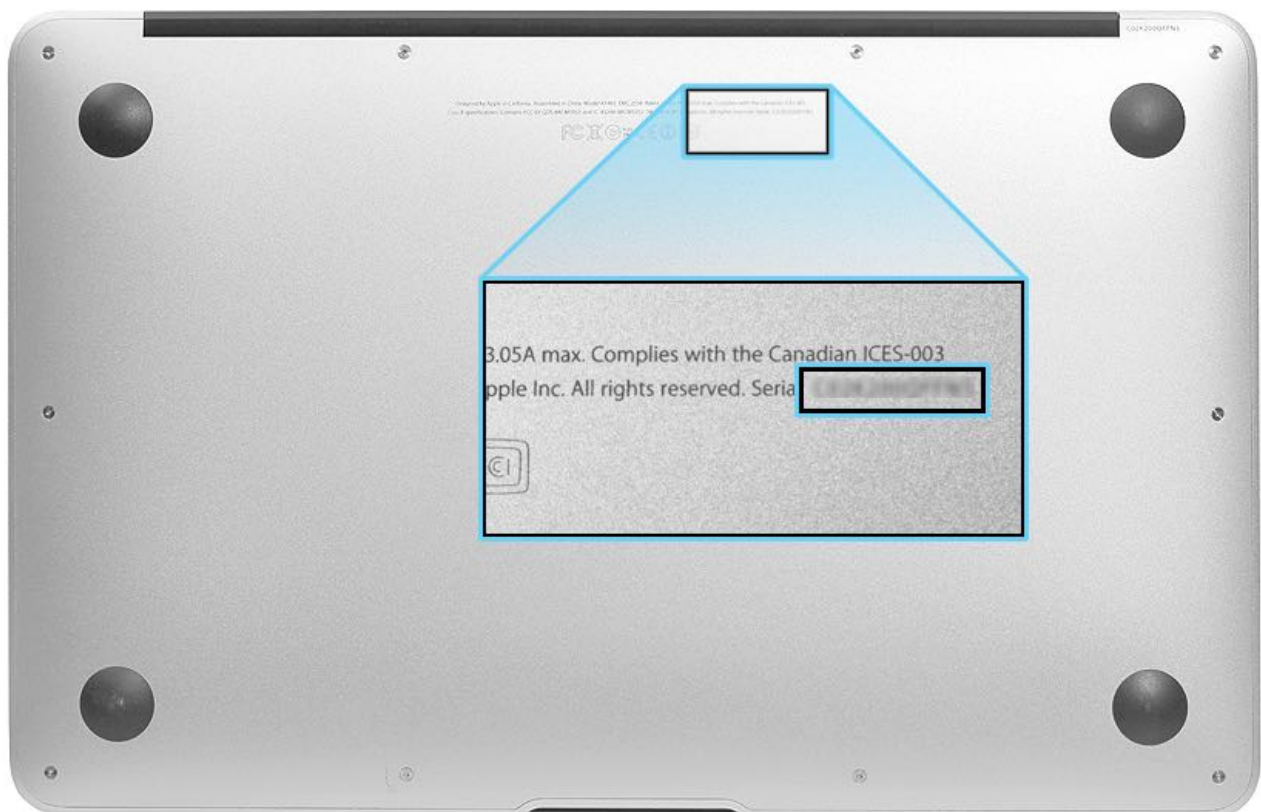
Serial Number Location

Turn computer over to see serial number etched on bottom case near hinge.

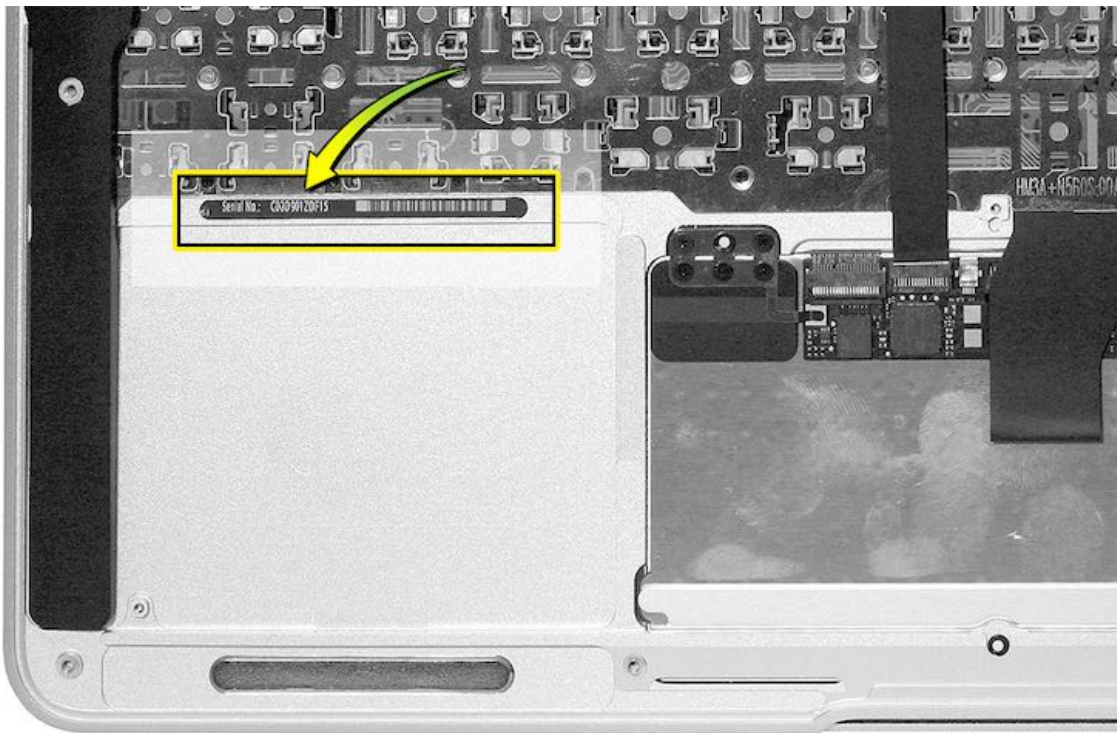
Late 2010, Mid 2011, and Mid 2012



Mid 2013, Early 2014, and Early 2015

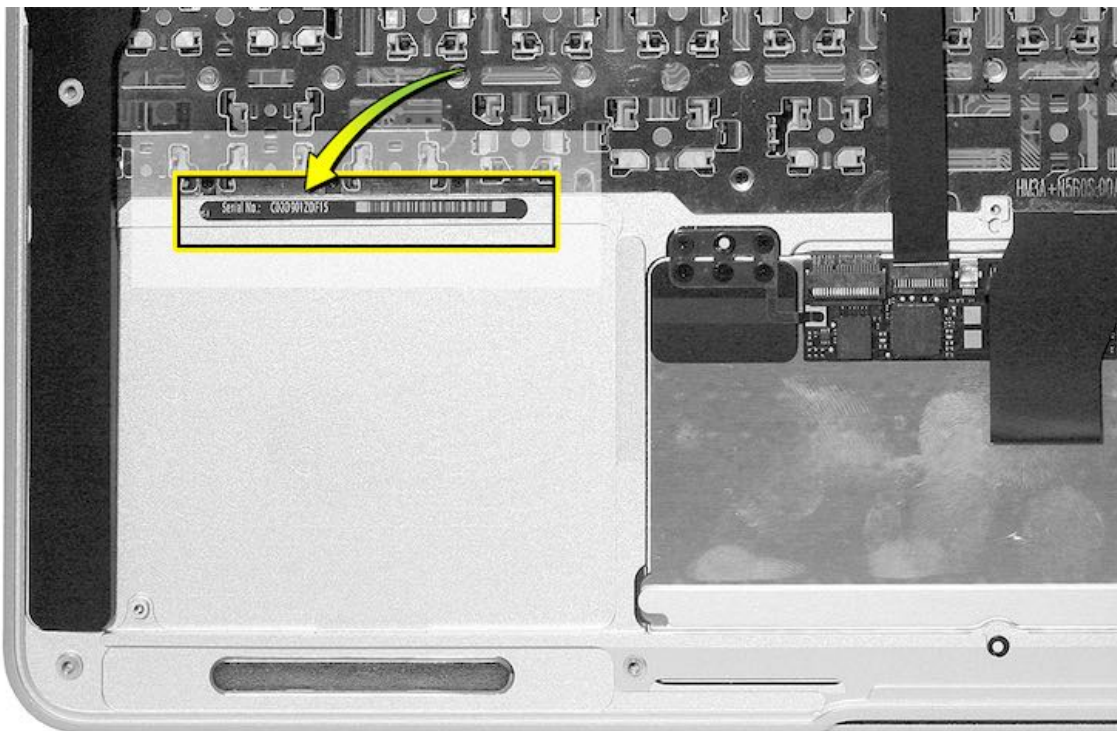


With battery removed, see serial number label on top case.

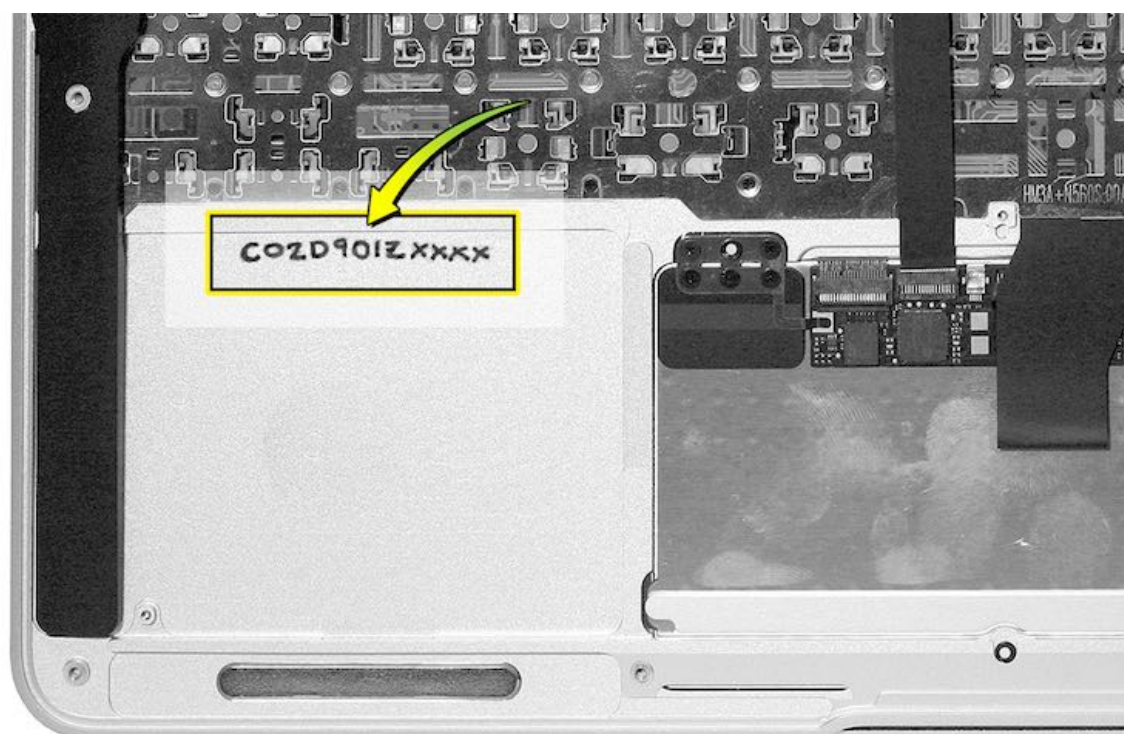


Transferring the Serial Number

When replacing a top case, retain user's top case until repair is complete. Before installing replacement top case, attach serial number label in the space between keyboard and palm rest.



If serial number label cannot be reused, use a fine-tipped permanent marker to write serial number on palm rest.



Visual/Mechanical Inspection (VMI) Guide for Mac Computers - Table of Contents

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- [Liquid Damage](#)
- [Power Adapters](#)
- [USB-C Cables](#)

Liquid Contact Indicators

Liquid Contact Indicators

Liquid Contact Indicators (LCIs) have been added to specific locations on current Mac portables to help determine if a computer has been exposed to liquid. Normally represented by small white dots, the LCIs turn red when they have come in contact with liquid, such as an accidental spill.

Important: The LCI is a tool that helps technicians identify whether or not a product has been in contact with liquid. Technicians should not rely solely on this tool, but should perform a thorough examination for signs of liquid contact, such as corrosion.

For more information, refer to article [HT204769: Mac computers: About liquid contact indicators \(LCIs\) and warranty coverage](#).

This image shows the general location of the LCIs in the computer. For LCIs that are not readily visible with the bottom case removed, check the same area under cables, on the other side of modules, or on the inside of the top case.

MacBook Air (11-inch, Late 2010, Mid 2011, Mid 2012, Mid 2013, Early 2014, Early 2015)



LCD Pixel Anomalies

When displaying a single color over the screen area, the LCD panel might show one or more pixels that are not properly lit.

LCD technology uses rows and columns of addressable points (pixels) that render text and images on the screen. Each pixel has three separate subpixels—red, green, and blue—that allow an image to render in full color. Each subpixel has a corresponding transistor responsible for turning that subpixel on and off.

Depending on the display size, there can be thousands or millions of subpixels on the LCD panel. For example, the LCD panel used in the iMac (27-inch, Late 2013) has a display resolution of 2560 by 1440, which means that there are 3.7 million pixels. Each pixel is made up of a red, a green, and a blue subpixel, resulting in over 11 million individual picture elements on the 27-inch display. Occasionally, a transistor may not work perfectly, which results in the affected subpixel remaining off (dark) or on (bright). With the millions of subpixels on a display, it is possible to have a low number of such transistors on an LCD. In some cases, a small piece of dust or other foreign material may appear to be a pixel anomaly. Apple strives to use the highest quality LCD panels in its products; however, pixel anomalies can occur in a small percentage of panels.

In some cases, pixel anomalies are caused by a piece of foreign material that is trapped somewhere inside the display or on the front surface of the display or glass panel. Foreign material is typically irregular in shape and is usually most noticeable when viewed against a white background.

- For any computer, foreign material on the outer surface of the display or glass panel can be easily removed using a lint-free cloth.
- For iMacs only, foreign material trapped between the glass panel and display should be removed by an Apple Authorized Service Provider or Apple Retail Store.
- For any computer, foreign material trapped inside the display can only be resolved by replacing the entire display assembly.

To determine if the display has an acceptable number of pixel anomalies, see the appropriate article:

- [HT202025: About LCD display pixel anomalies for Apple products released in 2010 and later](#)
- [HT201613: About LCD display pixel anomalies for Apple products released before 2010](#)

General Troubleshooting

Update Software and Firmware

Important: Before you begin troubleshooting, ensure the correct version of macOS is installed, and check for and apply the latest software and firmware updates. Computers sometimes exhibit symptoms that indicate the wrong version of macOS system software is installed. Check article [HT204319: macOS versions and builds included with Mac computers](#) to make sure system build is correct for this computer model.

Firmware is the name given to software that is written into memory circuits such as flash memory, that will hold the software code indefinitely, even when power is removed from the hardware. Firmware on Intel Mac computers is designed to be updated if necessary by running the macOS Software Update check (available in the Apple () menu) while the computer is connected to the Internet.

For more information about firmware updates, refer to article [HT201518: About EFI and SMC firmware updates for Intel-based Mac computers](#).

Troubleshooting Techniques

For more information, go to [ATLAS](#) and enter “troubleshooting” in the search field.

Hardware vs. Software

To isolate a hardware issue from a software issue, refer to article [HT203161: Isolating issues in macOS](#).

To troubleshoot a software issue, refer to the following articles:

- [HT201516: How to troubleshoot a software issue](#)
- [HT201861: About incompatible software on your Mac](#)
- [HT204323: If a flashing question mark appears when you start your Mac](#)
- [HT204904: How to reinstall macOS](#)
- [HT202574: Mac mini \(Late 2012 and later\), iMac \(Late 2012 and later\): About Fusion Drive](#)

Quick Check Procedures

Resetting the System Management Controller (SMC)

The System Management Controller (SMC) is a chip on the logic board that controls all power functions. If the computer is experiencing any power issue, such as not starting up, not displaying video, sleep issues, or fan noise issues, resetting SMC may resolve it.

For more information and instructions to reset the SMC on different computer models, refer to article [HT201295: How to reset the System Management Controller \(SMC\) on your Mac](#).

Note for iMacs: If the power button is pressed while inserting the power cord, the iMac will enter a mode in which the fans run at full speed. For more information, refer to article [HT204463: Fans run at full speed after computer turns on](#).

Note for iMac Pro (2017): If the power button is pressed while inserting the power cord, the iMac will enter DFU mode and will need to be restored.

Resetting Non-Volatile RAM (NVRAM)

NVRAM stores certain system and device settings in a location that macOS can access quickly. Exactly which settings are stored in the computer's NVRAM varies depending on the type of computer as well as the types of devices and drives connected. To reset NVRAM:

1. Shut down the computer.
2. Locate the following keys on the keyboard: Command, Option (Alt), P, and R. You will need to hold these keys down simultaneously in Step 4.
3. Press power button.
4. Immediately press and hold Command-Option-P-R keys.
Important: You must press this key combination before the gray screen appears.
5. Hold down keys until computer restarts, and you hear startup chime a second time.
Note: For MacBook Pro (Late 2016 and 2017) and MacBook (Retina, 12-inch, 2017), hold down keys for at least 20 seconds. There is no startup chime.
6. Release keys.

Note: After resetting NVRAM, you might need to reconfigure settings for speaker volume, screen resolution, startup disk selection, and time zone information.

For more information, refer to article [HT204063: How to Reset NVRAM on your Mac](#).

Starting Up in Safe Mode

Safe mode (sometimes called safe boot) is a way to start up a Mac so that it performs certain checks and prevents some software from automatically loading or opening. These changes can help resolve or isolate certain issues on the startup disk.

Follow these steps to start up into safe mode:

1. Be sure the computer is shut down.
2. Press the power button.
3. Press and hold the Shift key.
Note: The Shift key should be pressed as soon as possible after the power button is pressed.
4. Release the Shift key when you see the Apple logo appear on the screen. After the Apple logo appears, it may take longer than usual to reach the login screen. This is because the computer is performing a directory check as part of safe mode.
5. To leave safe mode, restart the computer without pressing any keys during startup.

For more information, refer to article [HT201262: Use safe mode to isolate issues with your Mac](#).

Sleep Status Tips

The following portable Mac models do not have a sleep LED:

- MacBook Air (Late 2010 and later)
- MacBook Pro (Retina, Mid 2012 to Mid 2015)

To troubleshoot without a sleep LED:

- Connect a USB device that has a power-on or activity LED. As power is restored to the USB and the system wakes from sleep, the LED lights up.
- Press Caps Lock key multiple times to wake the computer from sleep.
- Open display and press an alphanumeric key to wake the computer from sleep.
- A computer that has been asleep for an extended period can consume the remaining charge of the battery. Restore power to the computer with known-good power adapter, and check that the MagSafe indicator light shows an in-progress battery charge. The computer will boot from a hibernation file and start up from where it left off.
- Resetting SMC instantly shuts down the computer, with some side effects:
 - If the computer is in sleep mode, it will reboot from a hibernation file.
 - If the computer is booted to OS X or macOS during the SMC reset, data from open applications can be lost.
 - If the computer is already shut down, there will be no side effects.

Note: Look for the MagSafe indicator light to momentarily switch from off to green as SMC is reset and re-establishes communication with power adapter, then change from green to orange if the battery needs a charge.

Diagnostic Software

	Apple Service Diagnostic (ASD)	Apple Hardware Test (AHT)
MacBook Air (11-inch, Late 2010)	3S142	3A205
MacBook Air (11-inch, Mid 2011)	3S146	3A223
MacBook Air (11-inch, Mid 2012)	3S155	3A244
MacBook Air (11-inch, Mid 2013)	3S156	n/a
MacBook Air (11-inch, Early 2014)	3S156	n/a

Important: For models introduced before June 2013, use Apple Hardware Test (AHT). For models introduced in June 2013 or later, use Apple Diagnostics. For more information on Apple Diagnostics, refer to article [HT202731: Using Apple Diagnostics](#).

Apple Service Toolkit (AST)

AST is a suite of diagnostic tools that checks Intel-based Mac hardware components, and provides detailed diagnostic logs for review. AST runs on a local server, managing multiple Ethernet clients via NetBoot.

For more information, refer to articles:

- [OP476: Latest Apple Service Toolkit download links and documentation](#)
- [TP586: AST Reference Guide Table of Contents](#)

Mac Resource Inspector (MRI)

MRI, which is part of AST, is a quick triage tool that checks for the presence of hardware and reports sensor readings. Sensors are located on a variety of parts, including cables, fans, storage devices, power supply, display panel, and logic board. Use MRI to help isolate failures and avoid unnecessary part replacements. MRI complements ASD, which is a more in-depth repair verification tool.

Note: If all AST checks pass and a component is still suspected of fault, then verify with other diagnostic tools.

Cooling System Diagnostic (CSD)

CSD evaluates thermal sensors, fans, and heat sinks in late model MacBook Pro, MacBook Air, and iMac computers. It either confirms correct operation or helps diagnose service issues. CSD is useful when assisting users with questions about fan noise. This 30-40 minute test, designed for use at the repair bench, fully checks thermal efficiencies in MacBook Air (11-inch, Late 2010) and later models. This test requires a USB ambient temperature sensor, available for order via GSX (part number 922 - 9911).

Trackpad Keyboard Mapper

The Trackpad Keyboard Mapper pairs the trackpad and keyboard in the MacBook Air (Mid 2013, Early 2014, and Early 2015). To ensure correct keyboard behavior, this tool must be run whenever replacing a Mid 2013, Early 2014, or Early 2015 trackpad. For more information, refer to article [TP1016: AST Reference Guide: Using the Trackpad Keyboard Mapper](#).

Diagnostic Software

Apple Service Toolkit 2 (AST 2)

AST 2 is a cloud-based diagnostic system to help technicians triage and verify repairs for iOS devices and Mac computers released in June 2014 and later, except for MacBook Pro (Retina, Mid 2014). With AST 2, technicians initiate diagnostics wirelessly on a user's device using a Diagnostic Console (a web application on a Mac or iPad). Technicians are also able to view diagnostic results on the Diagnostic Console.

For more information, refer to:

- [OP476: Latest Apple Service Toolkit download links and documentation](#)
- [TP1105: AST 2 for Mac Reference Guide - Table of Contents](#)
- [TP1118: AST 2 for Mac Reference Guide - Table of Contents \(Retail\)](#)

Apple Diagnostics

Apple Diagnostics is a customer-facing software tool that is built-in to all Mac computers released in June 2013 and later.

For more information, refer to:

- [HT202731: How to use Apple Diagnostics on your Mac](#)
- [HT203747: Apple Diagnostics: Reference codes](#)

Thermal and Electrical Sensors

Reference the tables below for MacBook Air (11-inch and 13-inch, Mid 2013, Early 2014, Early 2015) and MacBook Air (13-inch, 2017) sensor information.

Thermal Sensors

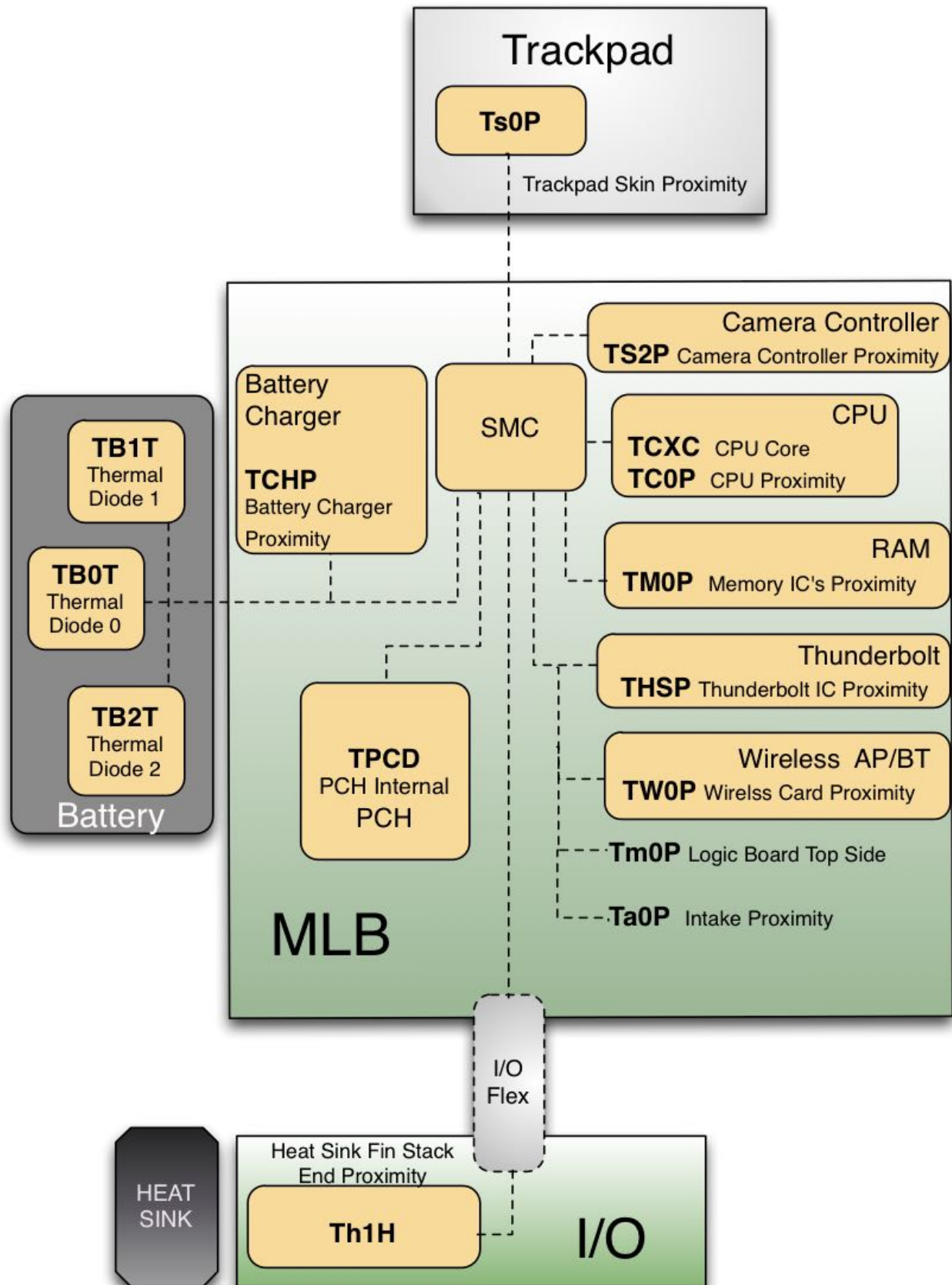
Thermal Sensor	Location	General Description	MR/ASD Name
Ta0P	Logic Board	Intake Proximity Temp	Intake Proximity Temp
TB0T	Battery	Internal Battery Sensor	Battery Thermal Diode 0
TB1T	Battery	Internal Battery Sensor	Battery Thermal Diode 1
TB2T	Battery	Internal Battery Sensor	Battery Thermal Diode 2
TC0P	Logic Board	Onboard CPU IC Proximity	CPU Proximity
TCHP	Logic Board	Battery Charger Proximity	Charger Proximity
TCXC	CPU Internal	CPU Core	CPU Core
Th1H	Left I/O board	Heat Sink Fin Stack End Proximity	Fin Stack
THSP	Logic Board	Thunderbolt IC Proximity	Thunderbolt Proximity
Tm0P	Logic Board	Logic Board Top Side	MLB Top Side
TM0P	Logic Board	Memory IC Proximity	Memory Proximity
TPCD	Logic Board	PCH Internal	PCH Die
Ts0P	Trackpad	Trackpad Skin Proximity	Trackpad Temp
TS2P	Logic Board	Camera Controller Proximity	S2 Camera Proximity
TW0P	Wireless Card or Logic Board	Wireless Card Proximity	AirPort Proximity

Electrical Sensors

Electrical Sensor	Location	General Description	MR/ASD Name
ALSL	Display	Ambient Light Sensor (Lux)	Light Sensor
MSLD	11-inch: Logic Board 13-inch: I/O Board	Clamshell Sleep Sensor (Closed/Open)	Magnetometer
CURRENT			
IC0R	Logic Board	CPU High (Core/AXG/DDR3/IO/SA) (Current)	Chipset 0 INA Highside
ID0R	Logic Board	DC In (Current)	DC in
IPB1	Logic Board	Battery Monitoring (Discrete)	Discrete Battery
IPBR	Logic Board	Battery Charger Monitoring (Current)	Charger BMON (Prod)
ISDC	Logic Board	SSD (Current)	SSD
VOLTAGE			
VAPC	Logic Board	Wireless Card (Voltage)	WLAN 3.3V
VC1C	Logic Board	CPU IO 1.05V (Voltage)	1.05 S0
VCS0	Logic Board	CPU Core (Voltage)	CPU Core
VD0R	Logic Board	DC In (Voltage)	DC in
VP0R	Logic Board	P-Bus (Voltage)	P-Bus
VSDC	Logic Board	SD Card (Voltage)	SD Card 3.3V (13-inch model only)
POWER			
PB1R	Logic Board	Battery Monitoring (Power)	Discrete BMON on Battery Power
PC0R	Logic Board	CPU Computing High Side (Power)	CPU Computing High Side
PDTR	Logic Board	AC/DC Output (Power)	AC/DC Output
PPBR	Logic Board	PBus on Battery (Power)	PBus on Battery Power
PSDC	Logic Board	SSD flash storage card (Power)	SSD Power

Thermal Sensor Map

The following map shows the general locations of thermal sensors and their associated parts within the computer housing.



Temperature Concerns

The normal operating temperature of this computer is well within national and international safety standards. Nevertheless, users may be concerned about generated heat. To prevent an unnecessary repair, compare a user's computer to a similar running model under similar load, if available at the repair site.

For more information, refer to articles

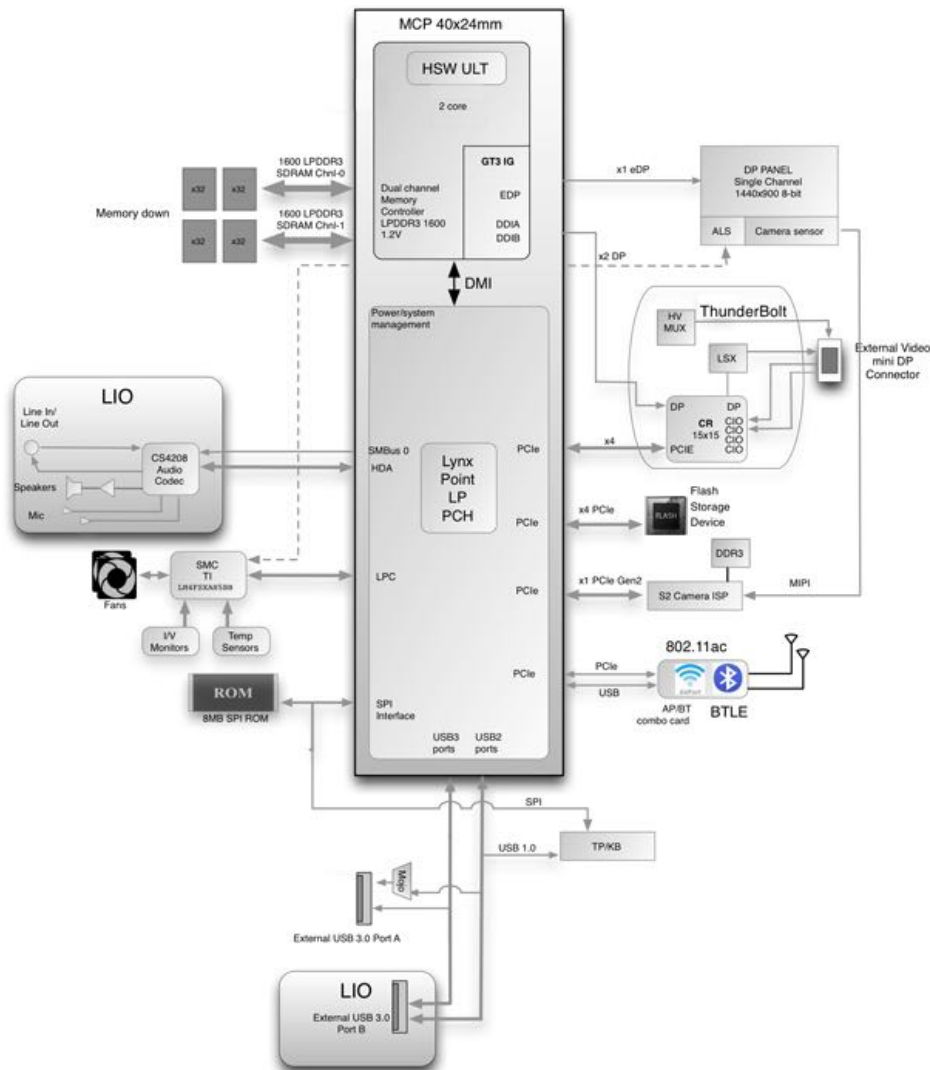
- [HT201640: Mac notebooks: Operating temperature](#)
- [HT203184: See how apps affect Mac performance, battery runtime, temperature, and fan activity](#)
- [HT202179: About fans and fan noise in your Mac](#)

Block Diagram

Block Diagram for MacBook Air (11-inch, Mid 2013, Early 2014, and Early 2015)

Refer to this diagram to see how modules are interrelated.

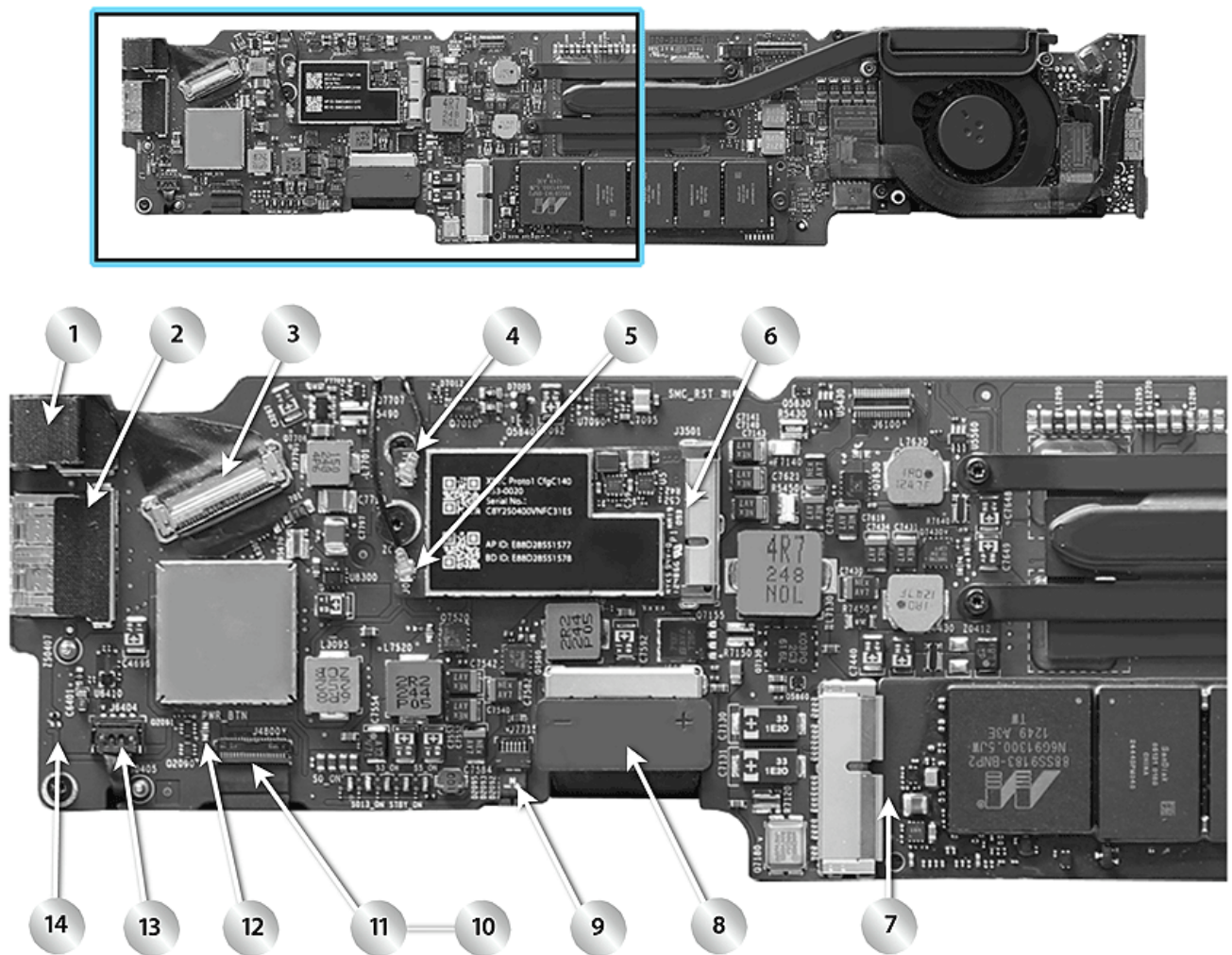
Note: The MacBook Air (Early 2015) uses the Intel Broadwell CPU chipset.



Functional Overview

Functional Overview for MacBook Air (11-inch, Mid 2013, Early 2014, and Early 2015)

Refer to these diagrams for symptoms related to connectors on the logic board and I/O board.



1 = Thunderbolt port:

- no Thunderbolt I/O to Thunderbolt system devices
- no video output to Thunderbolt display
- no video output to external Mini DisplayPort display
- no video output to external display connected via DVI/VGA adapter

2 = Right USB port:

- no power to USB device
- not mounting connected USB device
- no USB 3 high speed I/O support

3 = LCD/LCD backlight:

- no video on internal LCD
- video but no display backlight

4 = Wi-Fi/Bluetooth antenna connector:

- no/poor Wi-Fi reception
- drops Wi-Fi connection
- no pairing with Bluetooth devices
- drops Bluetooth connection

5 = Wi-Fi antenna connector:

- no/poor Wi-Fi reception
- drops Wi-Fi connection

6 = AirPort/Bluetooth card:

- Wi-Fi/Bluetooth device(s) not seen in System Information
- Wi-Fi service cannot be enabled
- Bluetooth service cannot be enabled

7 = Flash storage card:

- Flash storage device not visible in System Information
- OS boot failure from internal flash storage

8 = Battery:

- not running when on battery only
- not charging (verify with correct model of power adapter)
- X symbol for battery in menu bar
- battery removed—extended time before boot chime and fan running at full speed

9 = Keyboard backlight flex cable (part of top case):

- no keyboard backlight

10 = Keyboard flex cable (connected on trackpad board):

- no power on from keyboard
- non-responsive keys

11 = Trackpad/trackpad button/thermal sensor/keyboard/power ON button:

- no power on from keyboard
- non-responsive keys
- no multi-touch or cursor movement
- no click action
- trackpad thermal sensor input missing—fan running at full speed

12 = Power-on pads:

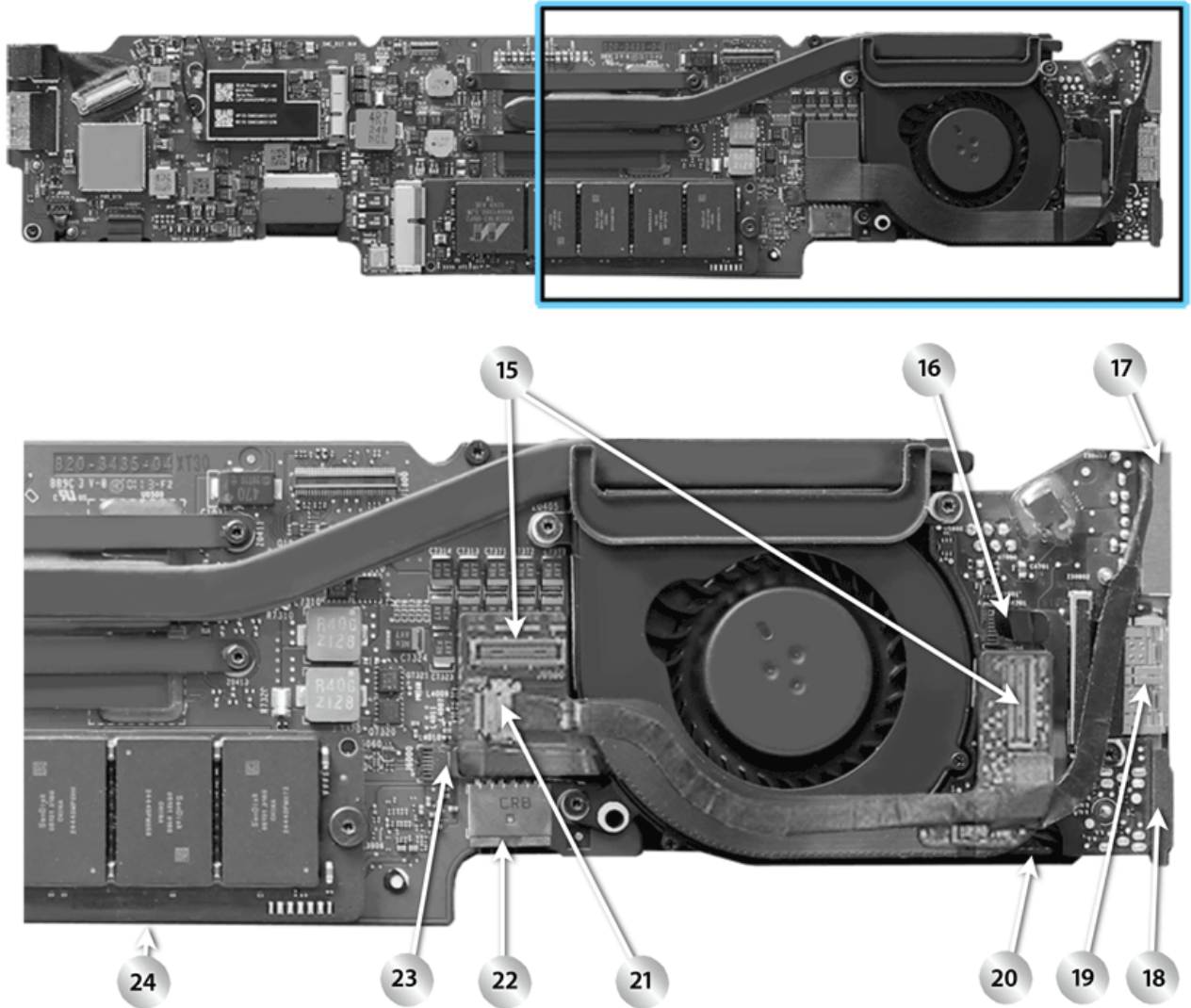
- when shorted, these pads can power on the computer (if keyboard cannot power on the computer or is disconnected)

13 = Right speaker:

- no or distorted audio from right speaker

14 = Sleep sensor:

- no sleep when display clamshell is closed
- no video to internal display, but video to external display if connected (sensor stuck)



15 = I/O flex cable:

- no power
- MagSafe LED off
- no audio
- no left USB
- no camera present
- heat sink thermal sensor missing—fan running at full speed

16 = Microphone:

- no internal audio input (with internal microphone selected in Sound Input Preferences)

17 = MagSafe connector:

- no power
- no MagSafe LED
- no battery charge

18 = Headphone jack (part of I/O board):

- no audio to connected headphone
- no audio to internal speakers

19 = Left USB port (part of I/O board):

- no power to USB device
- not mounting connected USB device
- no USB 3 high speed I/O support

20 = Left speaker (under I/O flex cable):

- no or distorted audio from left speaker

21 = FaceTime HD camera & Ambient Light Sensor (under I/O flex cable):

- no camera video, blurred or monochrome video
- no dimming of display in low light conditions
- keyboard backlight cannot be enabled

22 = I/O board power cable (under I/O flex cable):

- no power
- MagSafe LED off
- no audio, no left USB port

23 = Fan:

- fan not running
- noisy fan perception
- intermittent shutdown

24 = Onboard memory (on bottom side of logic board):

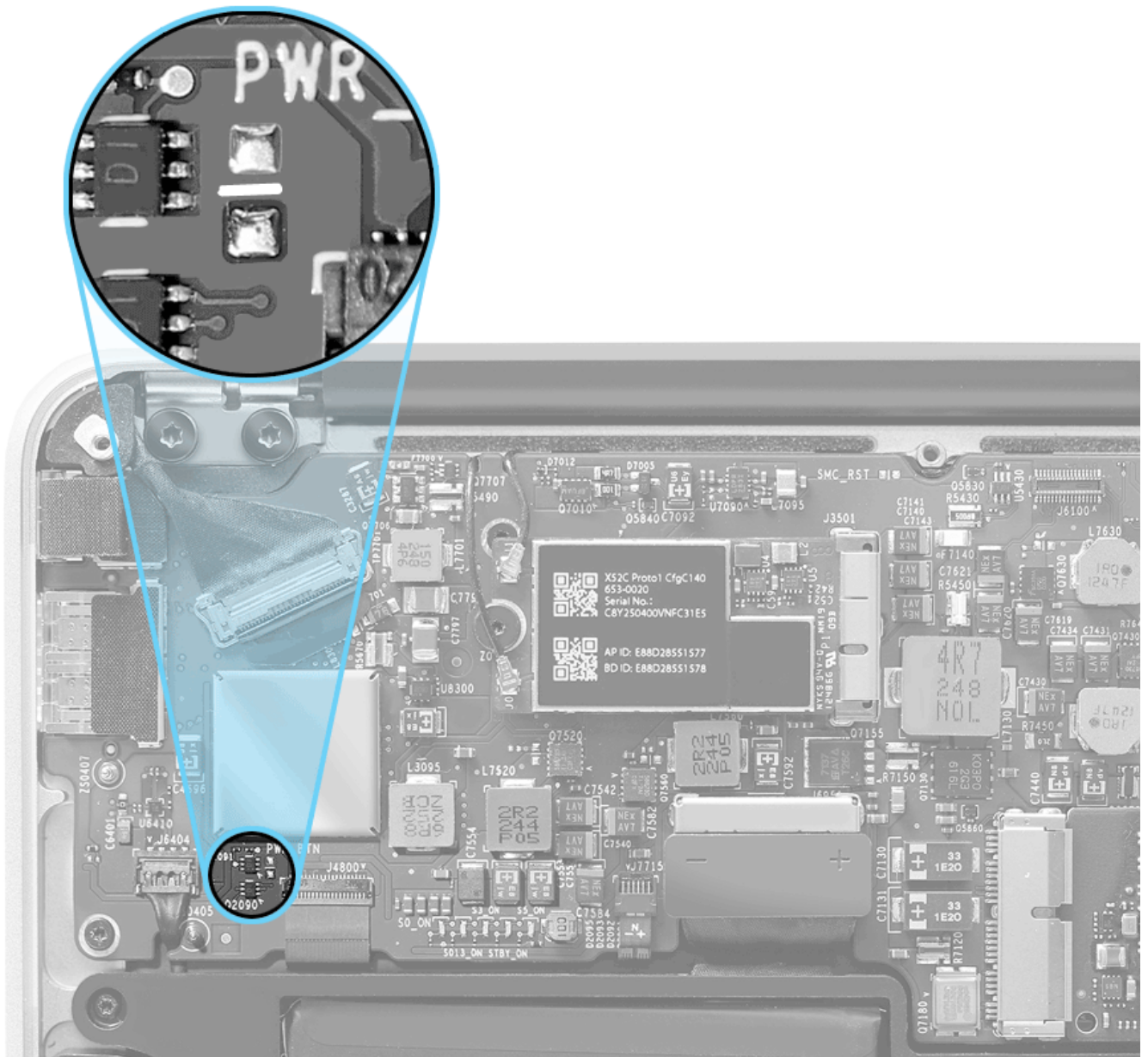
- three beep tones on startup
- freeze or kernel panic
- horizontal video lines

Logic Board Power-On Pads

Logic Board Power-On Pads for MacBook Air (11-inch, Mid 2013, Early 2014, and Early 2015)

If troubleshooting requires a need to start up the computer using the power-on pads, follow these steps:

1. To test startup on battery power, remove the bottom case only, and go to step 3.
2. To test startup using the power adapter, remove the bottom case and disconnect the battery cable to force logic board to use power adapter only.
3. Visually locate power-on pads next to IPD flex cable connector.
4. Using a jeweler's flat-blade screwdriver, touch power-on pads to power on logic board.
Caution: Avoid touching anything other than the power-on pads. Doing so could damage the logic board.
5. Listen for startup sound and/or fan operation to confirm power turns on.



Bluetooth Device Connection Issues

Unlikely causes:

Battery, bottom case, fan, flash storage, heat sink, I/O board, logic board, power adapter, speakers, top case, trackpad

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">Bluetooth can be turned on, but the computer is unable to pair with a known-good Bluetooth deviceIntermittent loss of communication with paired Bluetooth deviceData transfer over Bluetooth times out or is too slow <p>Note: Inform the user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables.</p>	<ol style="list-style-type: none">In System Preferences > Bluetooth, check that Bluetooth is on.Attempt to pair the computer with a known-good Bluetooth keyboard, mouse, or trackpad.Reset the Bluetooth device or delete the pairing (if applicable).Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates.If the customer is using a USB 3 device, review article HT201163: Using USB 3 devices with Mac computers to identify possible interference with Wi-Fi and Bluetooth communications if the device is positioned near their antennas.If the user's computer pairs Bluetooth normally at your service location, research potential sources of interference in the user's environment, such as microwave ovens or cordless phones in the 2.4/5GHz range. Refer to article HT201542: Potential sources of Wi-Fi and Bluetooth interference.Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.Reset the SMC using the procedure for this computer in article HT201295: Reset the System Management Controller (SMC) on your Mac.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Check Mac Resource Inspector (MRI) test results or System Information > Hardware > USB device tree to verify that the Bluetooth controller is listed. Is Bluetooth hardware detected?	Yes	Go to step 2.	\$(nodeText.yesSymptomCode)	
		No	Go to "Bluetooth Service Not Recognized" troubleshooting flow.	\$(nodeText.noSymptomCode)	
2.	Open System Preferences > Bluetooth. Remove all paired devices. Pair the computer with a known-good Bluetooth device. Does the computer pair with a known-good Bluetooth device?	Yes	Go to "External Apple Bluetooth Peripherals" troubleshooting flow.	\$(nodeText.yesSymptomCode)	
		No	Go to step 3.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
3.	<p>Start up the computer to an up-to-date, bootable macOS volume. Try to connect to a known-good Bluetooth device. Compare Bluetooth performance and reliability to a known-good computer of similar type and Bluetooth specification.</p> <p>Is the pairing issue resolved and is Bluetooth performance as expected?</p>	Yes	Reinstall macOS on the user's computer. Refer to HT204319: macOS versions and builds included with Mac computers to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 4.	`\${nodeText.noSymptomCode}`	
4.	<p>Locate the wireless antenna connections on the wireless card. Unplug them and inspect the antenna cables and their connectors for any signs of pinched wires or connector damage.</p> <p>Do the antenna cables or connectors show signs of damage?</p>	Yes	<p>The antenna cables are part of the display clamshell.</p> <p>Replace the display clamshell.</p> <p>Verify that the issue is resolved.</p>	L18	LCD
		No	Go to step 5.	`\${nodeText.noSymptomCode}`	
5.	<p>With the antenna cables unplugged, inspect the wireless antenna cable connectors on the wireless card for housing or pin damage.</p> <p>Do the antenna connectors on the wireless card show signs of damage?</p>	Yes	<p>Replace the wireless card.</p> <p>Verify that the issue is resolved.</p>	N17	WIRELESS DEVICE
		No	Go to step 6.	`\${nodeText.noSymptomCode}`	
6.	<p>Reseat the antenna cable connections to the wireless card, then retry pairing with a known-good Bluetooth device.</p> <p>Is the computer able to pair with a known-good Bluetooth device?</p>	Yes	The issue was resolved by reseating the antenna cable connections to the wireless card. Verify that the issue is resolved.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 7.	`\${nodeText.noSymptomCode}`	
7.	<p>To troubleshoot this issue completely, the following known-good parts are required:</p> <ul style="list-style-type: none"> Wireless card Display clamshell <p>Do you have immediate access to each of these known-good parts?</p>	Yes	Go to step 8.	`\${nodeText.yesSymptomCode}`	
		No	<p>Replace the wireless card.</p> <p>Verify that the issue is resolved.</p>	N15	WIRELESS DEVICE

	Check	Result	Action	Code	Commodity
8.	Substitute a known-good wireless card, then retry pairing with a known-good Bluetooth device. Is the computer able to pair with a known-good Bluetooth device?	Yes	Replace the wireless card. Verify that the issue is resolved.	N15	WIRELESS DEVICE
		No	Reinstall user's wireless card. Replace user's display clamshell. Verify that the issue is resolved.	L23	LCD
9.	Pair with a known-good Bluetooth device and verify that the connection is sustained for several minutes. Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain. Verify that the issue is resolved. Is the issue resolved?	Yes	The issue is resolved.	\${nodeText.yesSymptomCode}	
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	

Bluetooth Service Not Recognized

Unlikely causes:

Battery, bottom case, fan, flash storage, heat sink, I/O board, power adapter, speakers, top case, trackpad

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">Bluetooth cannot be enabled.Wireless card not available or recognized.Bluetooth intermittently becomes disabled. <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables.</p>	<ol style="list-style-type: none">In System Preferences > Bluetooth, check that Bluetooth is setting is available.Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates.Start up the computer using known-good original system media or an up-to-date, bootable macOS volume. Verify in System Preferences that Bluetooth setting is available.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Check Mac Resource Inspector (MRI) test results or System Information > Hardware > USB device tree to verify that the Bluetooth controller is listed. Is Bluetooth hardware detected?	Yes	Go to step 2.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 3.	`\${nodeText.noSymptomCode}`	
2.	Open and close the display fully several times to make sure the cables are not pinched or shorting. Retest with MRI or recheck System Information / System Profiler. Are Bluetooth, camera, and ALS hardware detected?	Yes	Issue resolved or could not be reproduced. Return computer to user.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 3.	`\${nodeText.noSymptomCode}`	
3.	The wireless card is connected directly to a socket on the logic board. Remove the bottom case and disconnect battery, then remove the wireless card and inspect the card connector for damage. Does wireless card connector show any damage?	Yes	Replace the wireless card. Verify that the issue is resolved.	N17	WIRELESS DEVICE
		No	Go to step 4.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
4.	<p>Inspect the wireless card connector on the logic board for housing or pin damage.</p> <p>Does the wireless card connector on the logic board show any damage?</p>	Yes	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M24	MLB
		No	Go to step 5.	\$(nodeText.noSymptomCode)	
5.	<p>Reinstall the wireless card on the logic board. Retest with MRI or recheck in System Information / System Profiler.</p> <p>Is Bluetooth hardware detected?</p>	Yes	Issue resolved by reseating the wireless card. Verify resolution.	\$(nodeText.yesSymptomCode)	
		No	Go to step 6.	\$(nodeText.noSymptomCode)	
6.	<p>To troubleshoot this issue completely, the following known-good parts are required:</p> <ul style="list-style-type: none"> Wireless card Logic board <p>Do you have immediate access to each of these known-good parts?</p>	Yes	Go to step 7.	\$(nodeText.yesSymptomCode)	
		No	<p>Replace the wireless card.</p> <p>Verify that the issue is resolved.</p>	N15	WIRELESS DEVICE
7.	<p>Substitute a known-good wireless card and retest with MRI or recheck System Information.</p> <p>Is Bluetooth hardware detected?</p>	Yes	<p>Replace the wireless card.</p> <p>Verify that the issue is resolved.</p>	N15	WIRELESS DEVICE
		No	Go to step 8.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
8.	<p>Substitute a known-good logic board and retest with MRI or recheck System Information.</p> <p>Is Bluetooth hardware detected?</p>	Yes	<p>Replace the logic board.</p> <p>Reinstall user's wireless card.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M36	MLB
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	
9.	<p>Run Mac Resource Inspector (MRI) to verify that Wi-Fi and Bluetooth are detected.</p> <p>Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Is the issue resolved?</p>	Yes	Issue resolved.	\${nodeText.yesSymptomCode}	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	

Thunderbolt Ethernet Issues

Unlikely causes:

Wireless card, battery, bottom case, display clamshell, fan, flash storage, heat sink, power adapter, speakers, top case, trackpad

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">No Apple Thunderbolt Ethernet Adapter device present when connectedNo Thunderbolt Ethernet service presentThunderbolt Ethernet service shows inactive link statusThunderbolt Ethernet service unable to get a valid IP addressSlow Ethernet network performance when using the Apple Thunderbolt Ethernet Adapter <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables.</p>	<ol style="list-style-type: none">Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model.Using alternate network setup (for example, Wi-Fi or Apple USB Ethernet adapter), check for and apply the latest software and firmware updates.Test with known-good network hardware and an Ethernet cable (Cat-5 or better is recommended for 100+ Mbps connections).Verify the network setup by connecting and accessing it from a known-good computer's Ethernet port.Connect known-good Apple Thunderbolt Ethernet Adapter to computer's Thunderbolt port and connect an Ethernet cable to it. Launch System Information and verify that the Thunderbolt to Gigabit Ethernet Adapter appears in the Thunderbolt devices tree.Launch System Preferences > Network and verify that a Thunderbolt Ethernet service appears on left side of window.In System Preferences > Network, click on the gear icon (near bottom left) and select "Set Service Order..." from popup menu. Drag "Thunderbolt Ethernet" to the top of the list and click OK, then click Apply.Connect known-good Ethernet network and cable to the Thunderbolt adapter, wait a few seconds, then check in System Preferences > Network that the link status indicator (dot to left of Thunderbolt Ethernet service) turns green. Alternatively, go to Network Utility > Info to verify that Link Status is Active.Check the network settings. If a known-good DHCP server is available, set System Preferences > Network > Ethernet to Using DHCP. Verify the IP address. If the IP address begins with 169.254.x.x, the system was unable to get a valid IP address. Force the computer to renew its current IP address using the 'Renew DHCP Lease' button in Network System Preferences.When started up from the built-in startup volume, revert to default network settings by creating a new location in System Preferences > Network.If no performance or connectivity issue is detected at technician site, the problem may be the user's network environment. Refer user to article TS1317: Troubleshooting a cable modem, DSL, or LAN Internet connection.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	<p>Inspect the Thunderbolt receptacle for any signs of deformation, damage, or debris that may be blocking the connection. Use compressed air to clear any obstructions or debris.</p> <p>Important: Do not use any metal objects to clear debris or obstructions, as this can short the connector and cause damage.</p> <p>Is the Thunderbolt port damaged?</p>	Yes	Go to step 2.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 3.	`\${nodeText.noSymptomCode}`	
2.	<p>Inspect the opening on the top case for the Thunderbolt receptacle. Determine whether the opening is misshapen or deformed, preventing proper insertion of Thunderbolt connectors.</p> <p>Is the opening for the Thunderbolt port damaged or deformed?</p>	Yes	<p>Replace the top case assembly.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	K16	KEYBOARD
		No	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M24	MLB

	Check	Result	Action	Code	Commodity
3.	<p>Start up the user's computer using a known-good, up-to-date, and bootable macOS volume.</p> <p>Connect the user's Thunderbolt Ethernet Adapter to computer's Thunderbolt port and connect an Ethernet cable to it.</p> <p>Retest for adapter presence in System Information > Thunderbolt.</p> <p>Is the Thunderbolt adapter detected when using a known-good OS?</p>	Yes	<p>Reinstall macOS on the user's computer. Refer to HT204319: macOS versions and builds included with Mac computers to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.</p>	\$(nodeText.yesSymptomCode)	
		No	Go to step 4.	\$(nodeText.noSymptomCode)	
4.	<p>Connect a known-good Apple Thunderbolt Ethernet Adapter to computer's Thunderbolt port and connect an Ethernet cable to it.</p> <p>Retest for adapter presence in System Information > Thunderbolt.</p> <p>Does the Thunderbolt Ethernet Adapter appear in the Thunderbolt devices tree?</p>	Yes	<p>The issue is isolated to the user's adapter.</p> <p>Replace the user's Apple Thunderbolt Ethernet Adapter.</p> <p>If user has third-party adapter, refer to manufacturer for support.</p>	X03	EXTERNAL CABLE
		No	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M33	MLB

	Check	Result	Action	Code	Commodity
5.	1. Connect the Ethernet cable to a known-good network with a DHCP server. 2. In System Preferences > Network > Ethernet, verify the link status is Connected (green dot). 3. Configure TCP/IP settings to Using DHCP and check that a valid IP address is obtained from the server (not a self-assigned one starting with 169.254.x.x). 4. Launch a web browser and verify that you can access websites and download files. 5. Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.	Yes	Issue resolved.	\${nodeText.yesSymptomCode}	
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	M99	
	Is the issue resolved?				

USB Ethernet Issues

Unlikely causes:

Wireless card, battery, bottom case, display clamshell, fan, flash storage, heat sink, power adapter, speakers, top case, trackpad

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• No Apple USB Ethernet Adapter device present when connected• No USB Ethernet service present• USB Ethernet service shows inactive link status• USB Ethernet service unable to get a valid IP address• Slow Ethernet network performance when using the Apple USB Ethernet Adapter <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables.</p>	<ol style="list-style-type: none">1. Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model.2. Using alternate network setup (for example, Wi-Fi or Apple Thunderbolt Ethernet adapter), check for and apply the latest software and firmware updates.3. Test with known-good network hardware and an Ethernet cable (Cat-5 or better is recommended for 100+ Mbps connections).4. Verify the network setup by connecting and accessing it from a known-good computer's Ethernet port.5. Connect known-good Apple USB Ethernet Adapter to computer's USB port and connect an Ethernet cable to it. Launch System Information and verify that the USB to Gigabit Ethernet Adapter appears in the USB devices tree.6. Move the Apple USB Ethernet Adapter to the other USB port. Relaunch System Information to verify that the Apple USB Ethernet Adapter appears in the USB devices tree.7. Launch System Preferences > Network and verify that a USB Ethernet service appears on left side of window.8. In System Preferences > Network, click on the gear icon (near bottom left) and select "Set Service Order..." from popup menu. Drag "USB Ethernet" to the top of the list and click OK, then click Apply.9. Connect known-good Ethernet network and cable to the USB adapter, wait a few seconds, then check in System Preferences > Network that the link status indicator (dot to left of USB Ethernet service) turns green. Alternatively, go to Network Utility > Info to verify that Link Status is Active.10. Check the network settings. If a known-good DHCP server is available, set System Preferences > Network > Ethernet to Using DHCP. Verify the IP address. If the IP address begins with 169.254.x.x, the system was unable to get a valid IP address. Force the computer to renew its current IP address using the 'Renew DHCP Lease' button in Network System Preferences.11. When started up from the built-in startup volume, revert to default network settings by creating a new location in System Preferences > Network.12. If no performance or connectivity issue is detected at technician site, the problem may be the user's network environment. Refer user to article TS1317: Troubleshooting a cable modem, DSL, or LAN Internet connection.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	<p>Inspect both left and right USB receptacles for any signs of deformation, damage, or debris that may be blocking the connection. Use compressed air to clear any obstructions or debris.</p> <p>Important: Do not use any metal objects to clear debris or obstructions, as this can short the connector and cause damage.</p> <p>Is either USB port damaged?</p>	Yes	Go to step 2.	\${nodeText.yesSymptomCode}	
		No	Go to step 4.	\${nodeText.noSymptomCode}	
2.	<p>Inspect the openings on the top case for both USB receptacles. Determine whether either opening is misshapen or deformed, preventing proper insertion of USB connectors.</p> <p>Is either opening for the USB port damaged or deformed?</p>	Yes	<p>Replace the top case assembly.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	K16	KEYBOARD
		No	Go to step 3.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
3.	<p>The right USB port connector is part of the logic board, while the left one is part of the I/O board.</p> <p>Identify which USB port is damaged.</p> <p>Which USB port is damaged?</p>	Right USB port	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M24	MLB
		Left USB port	<p>Replace the I/O board.</p> <p>Verify that the issue is resolved.</p>	M24	OTHER BOARD
4.	<p>Start up the user's computer using a known-good, up-to-date, and bootable macOS volume.</p> <p>Connect the user's USB Ethernet Adapter to the right USB port and connect an Ethernet cable to it.</p> <p>Retest for adapter presence in System Information > USB.</p> <p>Then disconnect the user's USB Ethernet Adapter from the right USB port and connect it to the left USB port.</p> <p>Retest for adapter presence in System Information > USB.</p>	Yes	<p>Reinstall macOS on the user's computer. Refer to HT204319: macOS versions and builds included with Mac computers to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.</p>	<p>\$(nodeText.yesSymptomCode)</p>	
		No	Go to step 5.	<p>\$(nodeText.noSymptomCode)</p>	
	Is the user's adapter detected on both USB ports when using a known-good OS?				

	Check	Result	Action	Code	Commodity
5.	Start up the user's computer using a known-good, up-to-date, and bootable macOS volume.	Yes	The issue is isolated to the user's adapter.	X03	EXTERNAL CABLE
	Connect a known-good Apple USB Ethernet Adapter to the right USB port and connect an Ethernet cable to it.		Replace the user's Apple USB Ethernet Adapter.		
5.	Retest for adapter presence in System Information > USB.	No	If user has third-party adapter, refer to manufacturer for support.	\${nodeText.noSymptomCode}	
	Then disconnect the known-good Apple USB Ethernet Adapter from the right USB port and connect it to the left USB port .				
	Retest for adapter presence in System Information > USB.		Go to step 6.		
	Is the known-good adapter detected on both USB ports when using a known-good OS?				
6.	The right USB port connector is part of the logic board, while the left one is part of the I/O board.	Right USB port	Replace the logic board.	M15	MLB
			Use Blank Board Serializer (BBS) to set the computer's serial number.		
6.	Identify which USB port is not detected or functioning.	Right USB port	Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.	M15	MLB
			Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.		
	Which USB port is not detected or functioning?		Verify that the issue is resolved.		
		Left USB port	Go to step 7.	\${nodeText.noSymptomCode}	
7.	Remove the bottom case and disconnect battery. Disconnect the input/output (I/O) flex cable from the logic board and the I/O board .	Yes	Go to step 8.	\${nodeText.yesSymptomCode}	
		No	Go to step 9.	\${nodeText.noSymptomCode}	
	Inspect the cable and connectors for damage. Look for pinching or crimping, and damaged or bent pins.				
	Does the I/O flex cable show signs of damage?				

	Check	Result	Action	Code	Commodity
8.	Inspect the logic board and I/O board I/O connectors for damage. Is the connector on the logic board or I/O board also damaged?	Yes	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	
		No	Replace the I/O flex cable. Verify that the issue is resolved.	X03	INTERNAL CABLE
9.	While the I/O flex cable is removed, disconnect the I/O power cable from the logic board. Inspect the cable and connector for damage. Look for pinching or crimping, and damaged or bent pins. Does the I/O power cable show signs of damage?	Yes	Replace the I/O board. Verify that the issue is resolved.	M24	OTHER BOARD
		No	Go to step 10.	\$(nodeText.noSymptomCode)	
10.	Inspect the logic board I/O flex cable and power cable connectors for damage. Does either connector on the logic board show signs of damage?	Yes	Replace the logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	M24	MLB
		No	Go to step 11.	\$(nodeText.noSymptomCode)	
11.	Inspect the I/O board and I/O flex cable connector for damage. Does the connector on the I/O board show signs of damage?	Yes	Replace the I/O board. Verify that the issue is resolved.	M24	OTHER BOARD
		No	Go to step 12.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
12.	Reseat the I/O board flex cable and power cable connections to the logic board and I/O board.	Yes	Issue resolved by reseating the I/O flex cable or power cable. Verify that the issue is resolved.	`\${nodeText.yesSymptomCode}`	
	Reassemble computer, reconnect adapter to left USB port, and retest for adapter presence in System Information and System Preferences > Network. Is the adapter detected on the left USB port after reseating cables?	No	Go to step 13.	`\${nodeText.noSymptomCode}`	
13.	To completely troubleshoot this issue, the following known-good parts are required. <ul style="list-style-type: none"> I/O flex cable I/O board Do you have immediate access to each of these known-good parts?	Yes	Go to step 14.	`\${nodeText.yesSymptomCode}`	
		No	Replace the I/O flex cable. Verify that the issue is resolved.	X03	INTERNAL CABLE
14.	Substitute a known-good I/O flex cable.	Yes	Replace the I/O flex cable. Verify that the issue is resolved.	X03	INTERNAL CABLE
	Reassemble computer, reconnect adapter to left USB port, and retest for adapter presence in System Information and System Preferences > Network. Is the adapter detected with a known-good I/O flex cable?	No	Go to step 15.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
15.	<p>Substitute a known-good I/O board.</p> <p>Reassemble computer, reconnect adapter to left USB port, and retest for adapter presence in System Information and System Preferences > Network.</p> <p>Is the adapter detected with a known-good I/O board?</p>	Yes	<p>Replace the I/O board.</p> <p>Reinstall user's I/O flex cable.</p> <p>Verify that the issue is resolved.</p>	M15	OTHER BOARD
		No	<p>Replace the logic board.</p> <p>Reinstall user's I/O flex cable and I/O board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M21	MLB
16.	<ol style="list-style-type: none"> 1. Connect the Ethernet cable to a known-good network with a DHCP server. 2. In System Preferences > Network > Ethernet, verify the link status is Connected (green dot). 3. Configure TCP/IP settings to Using DHCP and check that a valid IP address is obtained from the server (not a self-assigned one starting with 169.254.x.x). 4. Launch a web browser and verify that you can access websites and download files. 5. Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain. <p>Is the issue resolved?</p>	Yes	Issue resolved.	\${nodeText.yesSymptomCode}	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	M99	

Wi-Fi Connection Issues

Unlikely causes:

Battery, bottom case, fan, flash storage, heat sink, logic board, power adapter, speakers, top case, trackpad

Quick Check

Symptoms	Quick Check
<p>Wi-Fi interface is present and can be enabled, but the following symptoms appear when using the service:</p> <ul style="list-style-type: none">• Unable to find or connect to wireless networks• Slow or stalled data transfers• Intermittent connection dropouts <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables.</p>	<ol style="list-style-type: none">1. In System Preferences > Network, check that Wi-Fi is on.2. Attempt to connect the computer to a known-good Wi-Fi network.3. Create a new network location in System Preferences.4. Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model. Using alternate network interface (for example, Apple Thunderbolt Ethernet Adapter), connect to Internet. Check for and apply the latest software and firmware updates.5. If the customer is using a USB 3 device, review article HT201163: Using USB 3 devices with Mac computers to identify possible interference with Wi-Fi and Bluetooth communications if the device is positioned near their antennas.6. If the user's computer connects normally to Wi-Fi at your service location, research potential sources of interference in the user's environment, such as microwave ovens or cordless phones in the 2.4/5GHz range. Refer to article HT201542: Potential sources of Wi-Fi and Bluetooth interference.7. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.8. Reset the SMC using the procedure for this computer in article HT201295: Reset the System Management Controller (SMC) on your Mac.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Check Mac Resource Inspector (MRI) test results or System Information > Network > Wi-Fi to verify that the wireless card is listed. Is Wi-Fi hardware detected?	Yes	Go to step 2.	\$(nodeText.yesSymptomCode)	
		No	Go to "Wi-Fi Service Not Recognized" troubleshooting flow.	\$(nodeText.noSymptomCode)	
2.	Run Wireless Diagnostics by holding down the Option key, clicking the wireless icon in the menu bar, and then choosing Open Wireless Diagnostics. Wireless Diagnostics can also be found at: /System/Library/CoreServices/Applications/WirelessDiagnostics.app. See article HT202663: About Wireless Diagnostics for more information about using wireless diagnostic utilities. Does the computer complete Wireless Diagnostics with no issues?	Yes	Go to step 3.	\$(nodeText.yesSymptomCode)	
		No	Go to step 4.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
3.	<p>Connect to a known-good wireless network and open Wireless Diagnostics > Window > Performance. Review the quality graph to evaluate the signal quality of the wireless connection. Verify that the signal is good or excellent, and that the transmission rate (Tx Rate) is comparable to another known-good computer of similar type and Wi-Fi specification. Where available, switch between 2.4GHz and 5GHz networks to verify that the signal quality is comparable to a known-good computer.</p> <p>Using a network with a high transmission rate, download a large file from a known-good website or file server. Compare network performance to another known-good computer of similar type and Wi-Fi specification. Verify throughput using Activity Monitor > Network.</p> <p>Are the performance and throughput comparable between the user's computer and a known-good computer?</p>	Yes	Wi-Fi performance is within specification. Verify that the issue is resolved.	\$(nodeText.yesSymptomCode)}	
		No	Go to step 4.	\$(nodeText.noSymptomCode)}	
4.	<p>Start up the computer to Recovery Partition or an up-to-date, bootable macOS volume. Try to connect to a known-good Wi-Fi network. Compare Wi-Fi performance and reliability to a known-good computer of similar type and Wi-Fi specification.</p> <p>Is the connection issue resolved and is Wi-Fi performance as expected?</p>	Yes	Reinstall macOS on the user's computer. Refer to HT204319: macOS versions and builds included with Mac computers to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.	\$(nodeText.yesSymptomCode)}	
		No	Go to step 5.	\$(nodeText.noSymptomCode)}	
5.	<p>Locate the wireless antenna connections on the wireless card. Unplug them and inspect the antenna cables and their connectors for any signs of pinched wires or connector damage.</p> <p>Do the antenna cables or connectors show signs of damage?</p>	Yes	<p>The antenna cables are part of the display clamshell.</p> <p>Replace the display clamshell.</p> <p>Verify that the issue is resolved.</p>	L18	LCD
		No	Go to step 6.	\$(nodeText.noSymptomCode)}	

	Check	Result	Action	Code	Commodity
6.	With the antenna cables unplugged, inspect the wireless antenna cable connectors on the wireless card for housing or pin damage.	Yes	Replace the wireless card. Verify that the issue is resolved.	N17	WIRELESS DEVICE
	Do the antenna connectors on the wireless card show signs of damage?	No	Go to step 7.	\$(nodeText.noSymptomCode)	
7.	Reseat the antenna cable connections to the wireless card. Make sure the connections are secure and correctly aligned and oriented.	Yes	The issue was resolved by reseating the antenna cable connections to the wireless card. Verify that the issue is resolved.	\$(nodeText.yesSymptomCode)	
	Retest Wi-Fi, comparing performance and throughput of user's computer with known-good computer. Is the connection issue resolved and is Wi-Fi performance as expected?	No	Go to step 8.	\$(nodeText.noSymptomCode)	
8.	To troubleshoot this issue completely, a known-good wireless card is required.	Yes	Go to step 9.	\$(nodeText.yesSymptomCode)	
	Do you have immediate access to a known-good wireless card?	No	Go to step 10.	\$(nodeText.noSymptomCode)	
9.	Substitute a known-good wireless card, then retest Wi-Fi, comparing performance and throughput of user's computer with known-good computer. Is the connection issue resolved and is Wi-Fi performance as expected?	Yes	Go to step 10.	\$(nodeText.yesSymptomCode)	
		No	Reinstall user's wireless card. Replace user's display clamshell. Verify that the issue is resolved.	L16	LCD
10.	Verify that the specific Wi-Fi symptom is best described as: • No or poor wireless signal.	Yes	Replace the wireless card. Verify that the issue is resolved.	N04	WIRELESS DEVICE
	Does this specific symptom describe the issue?	No	Go to step 11.	\$(nodeText.noSymptomCode)	
11.	Verify that the specific Wi-Fi symptom is best described as: • Random disconnection or network connection Issues.	Yes	Replace the wireless card. Verify that the issue is resolved.	N09	WIRELESS DEVICE
	Does this specific symptom describe the issue?	No	Go to step 12.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
12.	Verify that the specific Wi-Fi symptom is best described as:	Yes	Replace the wireless card. Verify that the issue is resolved.	N14	WIRELESS DEVICE
	<ul style="list-style-type: none"> Performance issue or slow connection. Does this specific symptom describe the issue?	No	Replace the wireless card. Verify that the issue is resolved.	N19	WIRELESS DEVICE
13.	Connect to a known-good wireless network and retest data throughput, checking for adequate transfer speeds.	Yes	Issue resolved.	`\${nodeText.yesSymptomCode}`	
	Verify that wireless connection is sustained for several minutes. Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain. Verify that the issue is resolved. Is the issue resolved?	No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	

Wi-Fi Service Not Recognized

Unlikely causes:

Battery, bottom case, fan, flash storage, heat sink, I/O board, power adapter, speakers, top case, trackpad

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">Wi-Fi cannot be enabled.Wireless card not available or recognized.Wi-Fi intermittently becomes disabled. <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables.</p>	<ol style="list-style-type: none">In System Preferences > Wi-Fi, check that Wi-Fi is setting is available.Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model. Using alternate network setup (for example Apple USB Ethernet adapter), check for and apply the latest software and firmware updates.Start up the computer using known-good original system media or an up-to-date, bootable macOS volume. Verify in System Preferences that Wi-Fi setting is available.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Check Mac Resource Inspector (MRI) test results or System Information > Network > Wi-Fi to verify that the wireless card is listed.	Yes	Go to step 2.	<code>\$(nodeText.yesSymptomCode)</code>	
	Is Wi-Fi hardware detected?	No	Go to step 3.	<code>\$(nodeText.noSymptomCode)</code>	
2.	Open and close the display fully several times to make sure the cables are not pinched or shorting. Retest with MRI or recheck System Information / System Profiler.	Yes	Issue resolved or could not be reproduced. Return computer to user.	<code>\$(nodeText.yesSymptomCode)</code>	
	Are Wi-Fi, camera, and ALS hardware detected?	No	Go to step 3.	<code>\$(nodeText.noSymptomCode)</code>	
3.	The wireless card is connected directly to a socket on the logic board. Remove the bottom case and disconnect battery, then remove the wireless card and inspect the card connector for damage.	Yes	Replace the wireless card. Verify that the issue is resolved.	N17	WIRELESS DEVICE
	Does wireless card connector show any damage?	No	Go to step 4.	<code>\$(nodeText.noSymptomCode)</code>	

	Check	Result	Action	Code	Commodity
4.	<p>Inspect the wireless card connector on the logic board for housing or pin damage.</p> <p>Does the wireless card connector on the logic board show any damage?</p>	Yes	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M24	MLB
		No	Go to step 5.	\${nodeText.noSymptomCode}	
5.	Reinstall the wireless card on the logic board. Retest with MRI or recheck in System Information / System Profiler.	Yes	Issue resolved by reseating the wireless card. Verify resolution.	\${nodeText.yesSymptomCode}	
	Is Wi-Fi hardware detected?	No	Go to step 6.	\${nodeText.noSymptomCode}	
6.	To troubleshoot this issue completely, a known-good wireless card is required.	Yes	Go to step 7.	\${nodeText.yesSymptomCode}	
	Do you have immediate access to a known-good wireless card?	No	<p>Replace the wireless card.</p> <p>Verify that the issue is resolved.</p>	N18	WIRELESS DEVICE

	Check	Result	Action	Code	Commodity
7.	Substitute a known-good wireless card and retest with MRI or recheck System Information. Is Wi-Fi hardware detected?	Yes	Replace the wireless card. Verify that the issue is resolved.	N18	WIRELESS DEVICE
		No	Replace the logic board. Reinstall user's wireless card. Use Blank Board Serializer (BBS) to set the computer's serial number. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	M35	MLB
8.	Run Mac Resource Inspector (MRI) to verify that Wi-Fi and Bluetooth are detected. Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain. Verify that the issue is resolved. Is the issue resolved?	Yes	The issue is resolved.	\${nodeText.yesSymptomCode}	
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	

Backlight Issue / No Backlight

Unlikely causes:

Wireless card, battery, bottom case, fan, flash storage, heat sink, power adapter, top case, trackpad

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">Display not illuminatedDisplay backlight fails after warmupDisplay backlight fails at certain brightness settingsUnit appears to turn on and operate, but no image is seen on the display <p>Note: Inform the user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables.</p>	<ol style="list-style-type: none">Adjust the brightness to the maximum setting.Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates.Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.Reset the SMC using the procedure for this computer in article HT201295: Reset the System Management Controller (SMC) on your Mac.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Connect an external display with Thunderbolt Digital AV Multiport Adapter or Thunderbolt VGA Multiport Adapter. Check to see if the external display shows any video upon startup. Does the external display show a video signal?	Yes	Go to step 2.	\$(nodeText.yesSymptomCode)	
		No	Go to the “No Video to External Display” troubleshooting flow.	\$(nodeText.noSymptomCode)	
2.	Check Mac Resource Inspector (MRI) results to verify that the LCD is detected. If AST or AST 2 is not available, go to System Information > Graphics/Displays to verify that the color LCD is recognized. Does MRI or System Information detect the internal LCD panel?	Yes	Go to step 3.	\$(nodeText.yesSymptomCode)	
		No	Go to the “Power But Blank/No Video” troubleshooting flow.	\$(nodeText.noSymptomCode)	
3.	Start up the computer normally. Clean the display glass of all fingerprints and dirt, then shine a bright light to illuminate the display. The Apple menu icon in the menu bar should always be visible and provides a reliable, high-contrast, and identifiable icon. Does the display show a legible image despite not being backlit?	Yes	Go to step 4.	\$(nodeText.yesSymptomCode)	
		No	Go to the “Power But Blank/No Video” troubleshooting flow.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
4.	Remove the bottom case and disconnect battery, then disconnect and inspect the eDP flex cable for damage. Look for pinching or crimping, and damaged or bent pins. Does the eDP flex cable show signs of damage?	Yes	Go to step 5.	\$(nodeText.yesSymptomCode}	
		No	Go to step 6.	\$(nodeText.noSymptomCode}	
5.	Inspect the logic board display connector for damage, paying attention to both the conductors and the locking bar. Is the connector on the logic board also damaged?	Yes	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	
		No	Replace the display clamshell. Verify that the issue is resolved.	L14	LCD
6.	Inspect the logic board display connector for damage, paying attention to both the conductors and the locking bar. Does the connector on the logic board show signs of damage?	Yes	Replace the logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	M24	MLB
		No	Go to step 7.	\$(nodeText.noSymptomCode}	
7.	Reseat the eDP flex cable connections on the logic board. Reseating the cable can restore the display backlight. Retest the internal display with a normal startup. An NVRAM reset may be required if the brightness was lowered during troubleshooting. Is backlight functionality restored?	Yes	The issue was resolved by reseating the eDP flex cable. Verify resolution.	\$(nodeText.yesSymptomCode}	
		No	Go to step 8.	\$(nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
8.	<p>Locate display backlight fuse on logic board. Refer to article OP478: Portable Computers: Backlight fuse location images. Test fuse continuity using a multimeter. For instruction on using a multimeter, see article HT3250: Using a digital multimeter.</p> <p>Note: A good fuse will have a measurement of zero to one ohm. If the fuse measures higher than one (>1) ohm, it is burned out. This may indicate a display backlight short. If so, this short could burn out a second logic board. Both the display and logic board should be replaced simultaneously to prevent further part damage.</p> <p>Is display backlight fuse burned out?</p>	Yes	Go to step 9.	\${nodeText.yesSymptomCode}	
		No	Go to step 12.	\${nodeText.noSymptomCode}	
9.	<p>To completely troubleshoot this issue, the following known-good parts are required.</p> <ul style="list-style-type: none"> • Display clamshell • Logic board <p>Do you have immediate access to each of these known-good parts?</p>	Yes	Go to step 10.	\${nodeText.yesSymptomCode}	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	M25	
10.	<p>Substitute a known-good display clamshell and known-good logic board, and retest backlight function.</p> <p>Is backlight functionality restored?</p>	Yes	Go to step 11.	\${nodeText.yesSymptomCode}	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	M25	

	Check	Result	Action	Code	Commodity
11.	Reinstall the user's display clamshell. Continue to use a known-good logic board and retest backlight function. Is backlight functionality restored?	Yes	Replace the logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	M25	MLB
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	M25	
12.	To continue troubleshooting this issue, a known-good display clamshell is required. Do you have immediate access to a known-good display clamshell?	Yes	Go to step 13.	\$(nodeText.yesSymptomCode)	
		No	Replace the display clamshell. Verify that the issue is resolved.	L09	LCD

	Check	Result	Action	Code	Commodity
13.	Substitute a known-good display clamshell and retest backlight function. Is backlight functionality restored?	Yes	Replace the display clamshell. Verify that the issue is resolved.	L09	LCD
		No	Replace the logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	M25	MLB
14.	Restart the computer and verify that the internal display, backlight, camera, and ambient light sensor are functioning normally. Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain. Verify that the issue is resolved. Are all issues resolved?	Yes	The issue is resolved.	\${nodeText.yesSymptomCode}	
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	

Cracked Display

Unlikely causes:

There are no unlikely causes for this issue.

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">Cracked LCD display	<p>If possible, run the AST or AST 2 MRI diagnostic prior to troubleshooting. Check for any service restrictions in the diagnostic results.</p> <ol style="list-style-type: none">Refer to guidelines in TP1138: Visual/Mechanical Inspection (VMI) Guide for Mac Portables Display Clamshells. <p>Note: Inform the user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: Determining and quoting accidental damage for Mac portables.</p>

Deep Dive

	Check	Result	Action	Code	Commodity
1.	<p>Determine whether issue involves a safety risk, such as glass fragments.</p> <p>Do not perform procedures that can be a safety risk to you or the user.</p> <p>Can you proceed safely?</p>	Yes	Go to step 2.	`\${nodeText.yesSymptomCode}`	
		No	<p>Replace the display assembly out of warranty.</p> <p>Escalate using safety procedures if user claims injury.</p>	L36	LCD
2.	<p>Refer to TP1138: Visual/Mechanical Inspection (VMI) Guide for Mac Portables Display Clamshells.</p> <p>Use the Visual/Mechanical Inspection (VMI) Guide to identify conditions that affect warranty and service eligibility.</p> <p>Is the computer in warranty and eligible for warranty service?</p>	Yes	Go to step 3.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 5.	`\${nodeText.noSymptomCode}`	
3.	<p>Probe to determine if the issue is caused by accidental damage.</p> <p>Is the issue caused by accidental damage?</p>	Yes	Go to step 5.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 4.	`\${nodeText.noSymptomCode}`	
4.	<p>Determine whether the display has a single crack, or multiple cracks, in the LCD.</p> <p>Refer to TP1138: Visual/Mechanical Inspection (VMI) Guide for Mac Portables Display Clamshells for specific instructions and criteria.</p> <p>Does the display have a single crack in the LCD, or multiple cracks?</p>	Single	Replace the display assembly.	L35	LCD
		Multiple	Replace the display assembly out of warranty.	L36	LCD
5.	<p>Determine whether the computer is eligible for out of warranty service or is ineligible for service.</p> <p>Is the computer eligible for out of warranty service?</p>	Yes	Go to step 6.	`\${nodeText.yesSymptomCode}`	
		No	Return computer to user. Due to damage, the computer is no longer eligible for support.	`\${nodeText.noSymptomCode}`	
6.	<p>Determine whether the display has a single crack, or multiple cracks, in the LCD.</p> <p>Refer to TP1138: Visual/Mechanical Inspection (VMI) Guide for Mac Portables Display Clamshells for specific instructions and criteria.</p> <p>Does the display have a single crack in the LCD, or multiple cracks?</p>	Single	Replace the display assembly.	L35	LCD
		Multiple	Replace the display assembly out of warranty.	L36	LCD

Display Anomalies

Unlikely causes:

Wireless card, battery, bottom case, fan, flash storage, heat sink, I/O board, power adapter, speakers, top case, trackpad

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• Distorted or blurred image• Pixel anomalies• Vertical/horizontal lines• Unstable flickering• Incorrect or missing colors• Nonuniform brightness at specific location• Vertical lines of nonuniform brightness repeating over the display• Image persistence or image sticking on screen• Light leakage around the display <p>Note: Inform the user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables.</p>	<p>Important: Follow instructions in TP1138: Visual/Mechanical Inspection (VMI) Guide for Mac Portables Display Clamshells to identify conditions that affect warranty and service eligibility.</p> <ol style="list-style-type: none">1. Compare an image on user's display with the same image on an equivalent, known-good portable computer display. Small variations in display quality are normal and expected, and may not indicate a service issue.2. Verify that System Preferences > Universal Access > Seeing > Enhance Contrast is set to Normal.3. Start up the computer using known-good original system media or an up-to-date, bootable macOS volume.4. Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates.5. Check System Preferences > Displays > Color for possible use of a custom display profile. Set profile to Color LCD.6. Check the brightness setting.7. Clean the glass panel and check for dust or debris.8. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.9. Reset the SMC using the procedure listed for this computer in article HT201295: Reset the System Management Controller (SMC) on your Mac.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	To start up into Safe Mode, press the power button; as soon as you hear the startup sound, hold down the Shift key. The Shift key should be held as soon as possible after the startup sound, but not before the sound. Release the Shift key when you see the gray Apple icon and the spinning gear.	Yes	Go to step 3.	\$(nodeText.yesSymptomCode)	
		No	Go to step 2.	\$(nodeText.noSymptomCode)	
	Does issue still occur in Safe Mode?				

	Check	Result	Action	Code	Commodity
2.	<p>Start up computer using an up-to-date, bootable macOS volume. See articles HT201314: About macOS Recovery and HT204319: macOS versions and builds included with Mac computers.</p> <p>Retest for display issue.</p> <p>Is normal video restored?</p>	Yes	Reinstall macOS on the user's computer. Refer to HT204319: macOS versions and builds included with Mac computers to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.	\$(nodeText.yesSymptomCode)	
		No	Go to step 3.	\$(nodeText.noSymptomCode)	
3.	<p>Run Mac Resource Inspector (MRI) from AST or AST 2 to check if the display is fully recognized by the computer.</p> <p>If MRI is not available, go to System Information > Graphics/Displays to verify that Color LCD is recognized.</p> <p>Is display hardware detected in MRI?</p>	Yes	Go to step 8.	\$(nodeText.yesSymptomCode)	
		No	Go to step 4.	\$(nodeText.noSymptomCode)	
4.	<p>Remove the bottom case and disconnect battery, then disconnect and inspect the eDP flex cable for damage. Look for pinching or crimping, and damaged or bent pins.</p> <p>Does the eDP flex cable show signs of damage?</p>	Yes	Go to step 5.	\$(nodeText.yesSymptomCode)	
		No	Go to step 6.	\$(nodeText.noSymptomCode)	
5.	<p>Inspect the logic board display connector for damage, paying attention to both the conductors and the locking bar.</p> <p>Is the connector on the logic board also damaged?</p>	Yes	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	
		No	Replace the display clamshell. Verify that the issue is resolved.	L14	LCD

	Check	Result	Action	Code	Commodity
6.	<p>Inspect the logic board display connector for damage, paying attention to both the conductors and the locking bar.</p> <p>Does the connector on the logic board show signs of damage?</p>	Yes	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M24	MLB
		No	Go to step 7.	\$(nodeText.noSymptomCode)	
7.	<p>Reseat the eDP flex cable connections on the logic board. Reseating the cable can restore normal video. Retest the internal display with a normal startup.</p> <p>An NVRAM reset may be required if the brightness was lowered during troubleshooting.</p> <p>Is normal video restored?</p>	Yes	The issue was resolved by reseating the eDP flex cable. Verify resolution.	\$(nodeText.yesSymptomCode)	
		No	Go to step 8.	\$(nodeText.noSymptomCode)	
8.	<p>Use the Display Anomalies test suite in AST 2 or compare an image on the user's display with the same image on an equivalent, known-good display.</p> <p>Of the eight issues below, determine if "unstable flickering" best describes the primary symptom:</p> <ul style="list-style-type: none"> • Unstable flickering • Distorted / blurred image • Vertical/horizontal lines • Pixel anomalies • Nonuniform brightness • Incorrect or missing colors • Light leakage around the display • Image persistence or image sticking on screen <p>Is the primary issue flickering of the display image?</p>	Yes	Go to "Unstable Flickering" troubleshooting flow.	\$(nodeText.yesSymptomCode)	
		No	Go to step 9.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
9.	<p>Use the Display Anomalies test suite in AST 2 or compare an image on the user's display with the same image on an equivalent, known-good display.</p> <p>Of the seven issues below, determine if “distorted / blurred image” best describes the primary symptom:</p> <ul style="list-style-type: none"> • Distorted / blurred image • Vertical/horizontal lines • Pixel anomalies • Nonuniform brightness • Incorrect or missing colors • Light leakage around the display • Image persistence or image sticking on screen <p>Is the primary issue distortion of the display image?</p>	Yes	Go to step 10.	\$(nodeText.yesSymptomCode)	
		No	Go to step 13.	\$(nodeText.noSymptomCode)	
10.	<p>Connect an external display with Thunderbolt Digital AV Multiport Adapter or Thunderbolt VGA Multiport Adapter. Check to see if the external display exhibits the same symptom upon startup.</p> <p>Does the external display exhibit the same symptom as the internal display?</p>	Yes	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M31	MLB
		No	Go to step 11.	\$(nodeText.noSymptomCode)	
11.	<p>To completely troubleshoot this issue, a known-good display clamshell is required.</p> <p>Do you have immediate access to a known-good display clamshell?</p>	Yes	Go to step 12.	\$(nodeText.yesSymptomCode)	
		No	Replace the display clamshell. Verify that the issue is resolved.	L04	LCD

	Check	Result	Action	Code	Commodity
12.	Substitute a known-good display clamshell to test logic board video output. Is a normal image restored on the display?	Yes	Replace the display clamshell. Verify that the issue is resolved.	L04	LCD
		No	Replace the logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	M04	MLB
13.	Use the Display Anomalies test suite in AST 2 or compare an image on the user's display with the same image on an equivalent, known-good display. Of the six issues below, determine if "vertical/horizontal lines" or "pixel anomalies" best describes the primary symptom: <ul style="list-style-type: none"> • Vertical/horizontal lines • Pixel anomalies • Nonuniform brightness • Incorrect or missing colors • Light leakage around the display • Image persistence or image sticking on screen Does the primary issue involve either lines or pixels?	Yes	Go to step 14.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 22.	`\${nodeText.noSymptomCode}`	
14.	Thoroughly clean the display surface to remove any dust or debris. Inspect display closely and determine whether pixel "anomalies" are actually dust or debris on surface of display panel. Was the issue resolved by cleaning the display?	Yes	The issue was resolved by cleaning the display. Verify resolution.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 15.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
15.	Shut down the unit and examine the area of the display that is affected by the symptom under a bright light source.	Yes	Replace the display clamshell. Verify that the issue is resolved.	L19	LCD
	Check that the area affected is not damaged by scratches, pits, or damage to the coating of the display. Refer to article TP1138: Visual/Mechanical Inspection (VMI) Guide for Mac Portables Display Clamshells for more information. Does the display surface appear damaged?	No	Go to step 16.	\$(nodeText.noSymptomCode)	
16.	Start an AST 2 session with the unit and run the Display Anomalies test suite.	Yes	Go to step 17.	\$(nodeText.yesSymptomCode)	
	If AST 2 is not available, attempt to view the affected area against a number of solid-color backgrounds. Use System Preferences > Desktop & Screen Saver > Desktop, and select “Solid Colors” under “Apple” in the left-hand column. Is the issue verified?	No	Explain to user that the display is within specifications. Do not replace the display clamshell. Verify resolution.	\$(nodeText.noSymptomCode)	
17.	Examine the affected area of the screen and determine whether it appears to be affected by a pixel issue (bright, dark, or foreign material) or an anomalous line (horizontal or vertical).	Yes	Go to step 19.	\$(nodeText.yesSymptomCode)	
	Is the issue in question a vertical or horizontal line or band?	No	Go to step 18.	\$(nodeText.noSymptomCode)	
18.	Use the Display Anomalies test suite in AST 2 to find all pixel anomalies present.	Yes	Replace the display clamshell. Verify that the issue is resolved.	L20	LCD
	If AST 2 is not available, use a solid desktop background in System Preferences > Desktop & Screen Saver. Refer to article HT202025: About LCD display pixel anomalies for Apple products released in 2010 and later to determine whether the number of defects in display exceeds specification. Does the number of pixel anomalies exceed the specified limit?	No	Explain to user that the display is within specifications. Do not replace the display clamshell. Verify resolution.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
19.	To completely troubleshoot this issue, a known-good display clamshell is required.	Yes	Go to step 20.	\$(nodeText.yesSymptomCode)	
	Do you have immediate access to a known-good display clamshell?	No	Go to step 21.	\$(nodeText.noSymptomCode)	
20.	Substitute a known-good display clamshell to test logic board video output.	Yes	Replace the logic board.	M04	MLB
	Is a normal image restored on the display?		Use Blank Board Serializer (BBS) to set the computer’s serial number.		
			Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.		
			Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.		
			Verify that the issue is resolved.		
		No	Go to step 21.	\$(nodeText.noSymptomCode)	
21.	Observe the symptom on the display and determine whether the lines are vertical or horizontal.	Yes	Replace the display clamshell. Verify that the issue is resolved.	L27	LCD
	Are the lines on the display vertical?	No	Replace the display clamshell. Verify that the issue is resolved.	L26	LCD
22.	Use the Display Anomalies test suite in AST 2 or compare an image on the user’s display with the same image on an equivalent, known-good display.	Yes	Go to step 23.	\$(nodeText.yesSymptomCode)	
	Of the four issues below, determine if “nonuniform brightness” best describes the primary symptom: <ul style="list-style-type: none">• Nonuniform brightness• Incorrect or missing colors• Light leakage around the display• Image persistence or image sticking on screen Is the primary issue nonuniform brightness?	No	Go to step 26.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
23.	Examine the image on the display closely and determine whether the uneven brightness is located on a single location or repeats over the display. Is the nonuniform brightness repeating over the entire display?	Yes	Go to step 24.	\$(nodeText.yesSymptomCode)	
		No	Replace the display clamshell. Verify that the issue is resolved.	L21	LCD
24.	To troubleshoot this issue completely, a known-good logic board is required. Do you have immediate access to a known-good logic board?	Yes	Go to step 25.	\$(nodeText.yesSymptomCode)	
		No	Replace the display clamshell. Verify that the issue is resolved.	L21	LCD
25.	Substitute a known-good logic board. Restart the unit and check the display for any change in symptoms. Is a normal image restored on the display?	Yes	Replace the logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	M25	MLB
		No	Replace the display clamshell. Verify that the issue is resolved.	L21	LCD
26.	Use the Display Anomalies test suite in AST 2 or compare an image on the user's display with the same image on an equivalent, known-good display. Of the three issues below, determine if "incorrect or missing colors" best describes the primary symptom: <ul style="list-style-type: none"> • Incorrect or missing colors • Light leakage around the display • Image persistence or image sticking on screen Is the primary issue incorrect or missing colors?	Yes	Go to step 27.	\$(nodeText.yesSymptomCode)	
		No	Go to step 30.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
27.	Go to System Preferences > Displays > Color to ensure that Color LCD is selected under the display profile. Inspect the display again for incorrect or missing colors.	Yes	The issue was resolved by setting a valid display profile. The user may have created an off-color calibration setting. Verify resolution.	\$(nodeText.yesSymptomCode)	
	Did changing the display profile correct the issue?	No	Go to step 28.	\$(nodeText.noSymptomCode)	
28.	To completely troubleshoot this issue, a known-good display clamshell is required.	Yes	Go to step 29.	\$(nodeText.yesSymptomCode)	
	Do you have immediate access to a known-good display clamshell?	No	Replace the display clamshell. Verify that the issue is resolved.	L02	LCD
29.	Substitute a known-good display clamshell to test logic board video output. Is a normal image restored on the display?	Yes	Replace the display clamshell. Verify that the issue is resolved.	L02	LCD
		No	Replace the logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	M04	MLB
30.	Use the Display Anomalies test suite in AST 2 or compare an image on the user's display with the same image on an equivalent, known-good display.	Yes	Go to step 31.	\$(nodeText.yesSymptomCode)	
	Of the two issues below, determine if "light leakage around the display" best describes the primary symptom: <ul style="list-style-type: none"> • Light leakage around the display • Image persistence or image sticking on screen Is the primary issue light leakage around the display?	No	Go to step 33.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
31.	To troubleshoot this issue completely, a known-good display clamshell is required.	Yes	Go to step 32.	\${nodeText.yesSymptomCode}	
	Do you have immediate access to a known-good display clamshell?	No	Replace the display clamshell. Verify that the issue is resolved.	L28	LCD
32.	Substitute a known-good display clamshell and retest the issue with a normal startup or by using the Display Anomalies test suite in AST 2.	Yes	Replace the display clamshell. Verify that the issue is resolved.	L28	LCD
	Did replacing the display clamshell resolve the issue?	No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	L28	
33.	A display might show a temporary faint remnant of a previous image even after a new image replaces it. Follow instructions using procedure listed for this computer in article TP949: Image Persistence Test to determine if display fails or passes the Image Persistence Test.	Yes	Replace the display clamshell. Verify that the issue is resolved.	L25	LCD
	Does the display fail the Image Persistence Test?	No	The display is within specification. Do not replace display clamshell.	\${nodeText.noSymptomCode}	
34.	Verify that display issue or anomaly has been resolved.	Yes	Issue resolved.	\${nodeText.yesSymptomCode}	
	Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain. Verify that the issue is resolved. Is the issue resolved?	No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	M99	

No Video to External Display

Unlikely causes:

Wireless card, battery, bottom case, display clamshell, fan, flash storage, heat sink, power adapter, top case, trackpad

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">External display not detected by computerExternal display does not show any video, but internal display does <p>Note: Inform the user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables.</p>	<ol style="list-style-type: none">Gather display type and model information from the user.Always use a known-good display adapter and known-good external display equipped with internal speaker(s) to verify the computer. If using a Mini DisplayPort adapter, review article HT204149: Apple Mini DisplayPort adapters: Frequently asked questions (FAQ) for details on supported configurations. If using a Thunderbolt adapter, review HT204154: About Thunderbolt ports and displays.Refer to article HT201177: Get help with video issues on external displays connected to your Mac for common causes of video issues.On the external display, verify that the correct input has been selected.In System Preferences > Displays, verify that external display is detected and enabled.Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.Reset the SMC using the procedure for this computer in article HT201295: Reset the System Management Controller (SMC) on your Mac. If using with a computer set in target display mode, also reset SMC on the computer used as a display.Refer to article HT204319: macOS versions and builds included with Mac computers to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Inspect the Thunderbolt receptacle for any signs of deformation, damage, or debris that may be blocking the connection. Use compressed air to clear any obstructions or debris.	Yes	Go to step 2.	\$(nodeText.yesSymptomCode)	
	Important: Do not use any metal objects to clear debris or obstructions, as this can short the connector and cause damage.	No	Go to step 3.	\$(nodeText.noSymptomCode)	
	Is the Thunderbolt port damaged?				

	Check	Result	Action	Code	Commodity
2.	<p>Inspect the opening on the top case for the Thunderbolt receptacle. Determine whether the opening is misshapen or deformed, preventing proper insertion of Thunderbolt connectors.</p> <p>Is the opening for the Thunderbolt port damaged or deformed?</p>	Yes	<p>Replace the top case assembly.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	K16	KEYBOARD
		No	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M24	MLB

	Check	Result	Action	Code	Commodity
3.	<p>Start up the user's computer using a known-good, up-to-date, and bootable macOS volume.</p> <p>Connect the known-good display using a compatible, known-good display adapter to the user's computer.</p> <p>Check System Preferences > Displays for an available external Thunderbolt, Mini DisplayPort, VGA, DVI, or HDMI display type. Select the available device type.</p> <p>Verify that the external display can be selected and that a good image appears on the external display.</p> <p>Does a good image appear on the external display?</p>	Yes	<p>Reinstall macOS on the user's computer. Refer to HT204319: macOS versions and builds included with Mac computers to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.</p>	\$(nodeText.yesSymptomCode)	
		No	Go to step 4.	\$(nodeText.noSymptomCode)	
4.	<p>Connect the known-good display using the user's display adapter to the user's computer.</p> <p>Check System Preferences > Displays for an available external Thunderbolt, Mini DisplayPort, VGA, DVI, or HDMI display type. Select the available device type.</p> <p>Verify that the external display can be selected and that a good image appears on the external display.</p> <p>Does a good image appear on the external display?</p>	Yes	<p>The issue is isolated to the user's adapter.</p> <p>Replace the user's Apple display adapter.</p> <p>If user has third-party adapter, refer to manufacturer for support.</p>	X03	EXTERNAL CABLE
		No	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M26	MLB

	Check	Result	Action	Code	Commodity
5.	Connect a known-good, compatible display to computer and verify that: <ul style="list-style-type: none"> • Display is functional at computer startup. • Display is functional after computer is put to sleep and then awakened. • Other display features are also available (depending on display model: USB, audio, USB, Ethernet, etc.). 	Yes	Issue resolved.	\${nodeText.yesSymptomCode}	
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	M99	
	Run AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.				
	Verify that the issue is resolved.				
	Is the issue resolved?				

Power But Blank/No Video

Unlikely causes:

Wireless card, battery, bottom case, fan, flash storage, heat sink, I/O board, power adapter, speakers, top case, trackpad

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">Unit turns on, but no video is present on built-in displayVideo is present on external display but not on built-in displayNo video is present on built-in display but Caps Lock key illuminates when pressed <p>Note: Inform the user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables.</p>	<ol style="list-style-type: none">Use controls to increase screen brightness.Disconnect all peripherals.Use macOS Recovery to troubleshoot potential software issues. Hold down Command-R during startup to restart from the recovery partition. Refer to HT201314: About macOS Recovery.Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates, especially those that deal with display or graphic issues.Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.Reset the SMC using the procedure listed for this computer in article HT201295: Reset the System Management Controller (SMC) on your Mac.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Connect a known-good external display, keyboard, and mouse with a known-good Thunderbolt VGA or Digital AV adapter. Turn on the computer and close the display clamshell. Use an external keyboard or mouse to ensure that the unit stays awake and check to see if the external display correctly displays video.	Yes	Go to step 2.	\$(nodeText.yesSymptomCode)	
	Does the external display function normally?	No	Go to the “No Video to External Display” troubleshooting flow.	\$(nodeText.noSymptomCode)	
2.	Refer to HT204319: macOS versions and builds included with Mac computers to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates.	Yes	The issue is resolved. Verify resolution.	\$(nodeText.yesSymptomCode)	
	Recheck video on the built-in display.	No	Go to step 3.	\$(nodeText.noSymptomCode)	
	Does the built-in display function normally?				

	Check	Result	Action	Code	Commodity
3.	Start up the computer normally. Clean the display glass of all fingerprints and dirt, then shine a bright light to illuminate the display.	Yes	Go to the “Backlight Issue / No Backlight” troubleshooting flow.	\$(nodeText.yesSymptomCode)	
	The Apple menu icon in the menu bar should always be visible and provides a reliable, high-contrast, and identifiable icon.	No	Go to step 4.	\$(nodeText.noSymptomCode)	
4.	Does the display show a legible image despite not being backlit?				
	While observing the issue, move the display clamshell back and forth.	Yes	Go to step 5.	\$(nodeText.yesSymptomCode)	
5.	Open and close the display fully several times to make sure the cables are not pinched or shorting.	No	Go to step 9.	\$(nodeText.noSymptomCode)	
	Does the symptom change with display movement?				
6.	Remove the bottom case and disconnect battery, then disconnect and inspect the eDP flex cable for damage. Look for pinching or crimping, and damaged or bent pins.	Yes	Go to step 6.	\$(nodeText.yesSymptomCode)	
	Does the eDP flex flex cable show signs of damage?	No	Go to step 7.	\$(nodeText.noSymptomCode)	
6.	Inspect the logic board display connector for damage, paying attention to both the conductors and the locking bar.	Yes	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	
	Is the connector on the logic board also damaged?	No	Replace the display clamshell. Verify that the issue is resolved.	L14	LCD

	Check	Result	Action	Code	Commodity
7.	<p>Inspect the logic board display connector for damage, paying attention to both the conductors and the locking bar.</p> <p>Does the connector on the logic board show signs of damage?</p>	Yes	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M24	MLB
		No	Go to step 8.	\$(nodeText.noSymptomCode)	
8.	<p>Reseat the eDP flex flex cable connections on the logic board. Reseating the cable can restore normal video. Retest the internal display with a normal startup.</p> <p>An NVRAM reset may be required if the brightness was lowered during troubleshooting.</p> <p>Is normal video restored?</p>	Yes	The issue was resolved by reseating the eDP flex cable. Verify resolution.	\$(nodeText.yesSymptomCode)	
		No	Go to step 9.	\$(nodeText.noSymptomCode)	
9.	<p>To troubleshoot this issue completely, a known-good display clamshell is required.</p> <p>Do you have immediate access to a known-good display clamshell?</p>	Yes	Go to step 10.	\$(nodeText.yesSymptomCode)	
		No	<p>Replace the display clamshell.</p> <p>Verify that the issue is resolved.</p>	L03	LCD

	Check	Result	Action	Code	Commodity
10.	Substitute a known-good display clamshell and attempt to reproduce the symptom. Is display functionality restored?	Yes	Replace the display clamshell. Verify that the issue is resolved.	L03	LCD
		No	Replace the logic board. Reinstall the user's display clamshell. Use Blank Board Serializer (BBS) to set the computer's serial number. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	M03	MLB
11.	Restart the computer and verify the image on the internal display, backlight, camera, and ambient light sensor are functioning normally. Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain. Are all issues resolved?	Yes	The issue is resolved.	\${nodeText.yesSymptomCode}	
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	M03	

Thunderbolt Target Display Mode Issues

Unlikely causes:

Wireless card, battery, bottom case, display clamshell, fan, flash storage, heat sink, power adapter, speakers, top case, trackpad

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">Computer does not initiate Thunderbolt target display mode connection.Thunderbolt-capable iMac does not switch to display mode when you press Command-F2 on the iMac keyboard (to activate target display mode). <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables.</p>	<ol style="list-style-type: none">Check that the computer intended to be used as the target display supports target display mode via Thunderbolt, and that a Thunderbolt cable is used. Refer to article HT204592: Use your iMac as a display with Target Display Mode.Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model.Using alternate network setup (for example, Wi-Fi or Apple USB Ethernet adapter), check for and apply the latest software and firmware updates.Check System Information > Hardware > Thunderbolt to verify that the Thunderbolt hardware is recognized.Try using a known-good Thunderbolt cable or adapter. See HT202488: Apple Thunderbolt cables and adapters.Try using a known-good Thunderbolt device or a Thunderbolt-capable computer in target disk mode. Refer to article HT201462: Use target disk mode to share files between two Mac computers.Refer to HT204154: Thunderbolt ports and displays: Frequently asked questions (FAQ) to verify that the computer has the latest Thunderbolt firmware versions installed.Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.Reset the SMC using the procedure for this computer in article HT201295: Reset the System Management Controller (SMC) on your Mac.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Inspect the Thunderbolt receptacle for any signs of deformation, damage, or debris that may be blocking the connection. Use compressed air to clear any obstructions or debris.	Yes	Go to step 2.	<code>\${nodeText.yesSymptomCode}</code>	
	Important: Do not use any metal objects to clear debris or obstructions, as this can short the connector and cause damage. Is the Thunderbolt port damaged?	No	Go to step 3.	<code>\${nodeText.noSymptomCode}</code>	

	Check	Result	Action	Code	Commodity
2.	<p>Inspect the opening on the top case for the Thunderbolt receptacle. Determine whether the opening is misshapen or deformed, preventing proper insertion of Thunderbolt connectors.</p> <p>Is the opening for the Thunderbolt port damaged or deformed?</p>	Yes	<p>Replace the top case assembly.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	K16	KEYBOARD
		No	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M24	MLB
3.	<p>Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model. The correct build contains Thunderbolt drivers that match the logic board Thunderbolt controller.</p> <p>Is the proper OS version installed?</p>	Yes	Go to step 4.	`\${nodeText.yesSymptomCode}`	
		No	<p>Reinstall macOS on the user's computer. Refer to HT204319: macOS versions and builds included with Mac computers to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.</p>	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
4.	<p>Check for and apply the latest software and firmware updates. Check System Information > Hardware > Thunderbolt. If no device is connected, the Thunderbolt controller should be listed as the type of computer (for example, MacBook Air) with a unique user ID (UID) and firmware version shown.</p> <p>Does System Information list Thunderbolt hardware?</p>	Yes	Go to step 5.	#{nodeText.yesSymptomCode}	
		No	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M33	MLB
5.	<p>Connect a known-good Thunderbolt device using a known-good Thunderbolt cable. Refresh System Information > Hardware > Thunderbolt. The Thunderbolt port status should change and show the connected Thunderbolt device.</p> <p>Does System Information list the connected Thunderbolt device?</p>	Yes	Go to step 6.	#{nodeText.yesSymptomCode}	
		No	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M33	MLB

	Check	Result	Action	Code	Commodity
6.	<p>To troubleshoot this issue completely, the following known-good parts are required:</p> <ul style="list-style-type: none"> Thunderbolt-capable iMac that supports Target Display Mode Thunderbolt to Thunderbolt cable <p>Do you have immediate access to each of these known-good parts?</p>	Yes	Go to step 7.	\${nodeText.yesSymptomCode}	
		No	<p>ESCALATION REQUIRED.</p> <p>Request ACS help checking latest updates and System Information > Hardware > Thunderbolt device tree.</p>	X99	
7.	<p>Connect a known-good Thunderbolt to Thunderbolt cable between user's computer and a known-good Thunderbolt-capable iMac. Start up both computers to desktop, then press Command-F2 on known-good iMac to activate target display mode for user's computer.</p> <p>Does known-good iMac become a target display for user's computer?</p>	Yes	Go to step 9.	\${nodeText.yesSymptomCode}	
		No	Go to step 8.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
8.	<p>Check System Information > Hardware > Thunderbolt on user's computer to verify Thunderbolt port connection and port status. The connection to the known-good iMac should show as "Macintosh."</p> <p>Hardware > Graphics > Displays should show any displays recognized by user's computer and list Color LCD and iMac display information.</p> <p>Does System Information list target display mode information?</p>	Yes	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support. Inform ACS that user's computer cannot activate target display mode on a known-good Thunderbolt-capable iMac, while it does show a Thunderbolt connection in System Information.</p>	M99	
		No	<p>Thunderbolt hardware is present, but not fully functioning.</p> <p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M32	MLB
9.	Inspect user's Thunderbolt to Thunderbolt cable for physical damage, such as contamination or burnt connectors on either end of the cable.	Yes	Replace the Thunderbolt to Thunderbolt cable. Verify issue resolved.	X26	EXTERNAL CABLE
	Is user's Thunderbolt cable damaged?	No	Go to step 10.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
10.	<p>Connect user's Thunderbolt to Thunderbolt cable between user's computer and a known-good Thunderbolt-capable iMac. Start up both computers to desktop, then press Command-F2 on known-good iMac to activate target display mode for user's computer.</p> <p>Does known-good iMac become a target display for user's computer?</p>	Yes	Issue cannot be duplicated.	\${nodeText.yesSymptomCode}	
		No	Replace the Thunderbolt to Thunderbolt cable. Verify issue resolved.	X26	EXTERNAL CABLE
11.	<p>Check System Information to confirm that the Thunderbolt hardware is recognized and has a unique UID, the most recent firmware version, and the correct link status.</p> <p>Run AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Is the issue resolved?</p>	Yes	Issue resolved.	\${nodeText.yesSymptomCode}	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	M99	

Unstable Flickering

Unlikely causes:

Wireless card, battery, bottom case, fan, flash storage, heat sink, power adapter, speakers, top case, trackpad

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">Flickering video imageFlickering backlightDock and/or menu bar position not stableDisplay intermittently flashes on/offUnstable image <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: Determining and quoting accidental damage for Mac portables.</p>	<p>Note: Verify the issue after using the computer for a few minutes to warm it, or by following steps in HT207571: Warm a Mac for testing. Doing this may help identify intermittent issues.</p> <ol style="list-style-type: none">Use macOS Recovery to troubleshoot potential software issues. Hold down Command-R during startup to restart from the recovery partition. See article HT201314: About macOS Recovery.Check that F1 and F2 brightness keys are not stuck, triggering display brightness changes.Refer to HT201260: How to find the macOS version number on your Mac to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates, especially those that deal with display or graphic issues.Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.Reset the SMC using the procedure listed for this computer in article HT201295: How to reset the System Management Controller (SMC) on your Mac.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Refer to HT201260: How to find the macOS version number on your Mac to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates.	Yes	The issue is resolved. Verify resolution.	\$(nodeText.yesSymptomCode)	
	Recheck video on the built-in display.	No	Go to step 2.	\$(nodeText.noSymptomCode)	
	Does the built-in display function normally?				
2.	Run Mac Resource Inspector (MRI) from AST or AST 2 to check if the display is fully recognized by the computer.	Yes	Go to step 3.	\$(nodeText.yesSymptomCode)	
	If MRI is not available, go to System Information > Graphics/Displays to verify that Color LCD is recognized.	No	Issue appears video-related. Go to “Power But Blank/No Video” troubleshooting flow.	\$(nodeText.noSymptomCode)	
	Is display hardware detected in MRI?				

	Check	Result	Action	Code	Commodity
3.	Start up the computer normally. Clean the display glass of all fingerprints and dirt, then shine a bright light to illuminate the display.	Yes	Go to the “Backlight Issue / No Backlight” troubleshooting flow.	\$(nodeText.yesSymptomCode)	
	The Apple menu icon in the menu bar should always be visible and provides a reliable, high-contrast, and identifiable icon.	No	Go to step 4.	\$(nodeText.noSymptomCode)	
4.	Does the display show a legible image despite not being backlit?				
	While observing the issue, move the display clamshell back and forth.	Yes	Go to step 5.	\$(nodeText.yesSymptomCode)	
5.	Open and close the display fully several times to make sure the cables are not pinched or shorting.	No	Go to step 9.	\$(nodeText.noSymptomCode)	
	Does the symptom change with display movement?				
6.	Remove the bottom case and disconnect battery, then disconnect and inspect the eDP flex cable for damage. Look for pinching or crimping, and damaged or bent pins.	Yes	Go to step 6.	\$(nodeText.yesSymptomCode)	
	Does the eDP flex cable show signs of damage?	No	Go to step 7.	\$(nodeText.noSymptomCode)	
6.	Inspect the logic board display connector for damage, paying attention to both the conductors and the locking bar.	Yes	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	
	Is the connector on the logic board also damaged?	No	Replace the display clamshell. Verify that the issue is resolved.	L14	LCD

	Check	Result	Action	Code	Commodity
7.	<p>Inspect the logic board display connector for damage, paying attention to both the conductors and the locking bar.</p> <p>Does the connector on the logic board show signs of damage?</p>	Yes	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M24	MLB
		No	Go to step 8.	\$(nodeText.noSymptomCode)	
8.	<p>Reseat the eDP flex cable connections on the logic board. Reseating the cable can restore normal video. Retest the internal display with a normal startup.</p> <p>An NVRAM reset may be required if the brightness was lowered during troubleshooting.</p> <p>Is normal video restored?</p>	Yes	The issue was resolved by reseating the eDP flex cable. Verify resolution.	\$(nodeText.yesSymptomCode)	
		No	Go to step 9.	\$(nodeText.noSymptomCode)	
9.	<p>To troubleshoot this issue completely, a known-good display clamshell is required.</p> <p>Do you have immediate access to a known-good display clamshell?</p>	Yes	Go to step 10.	\$(nodeText.yesSymptomCode)	
		No	<p>Replace the display clamshell.</p> <p>Verify that the issue is resolved.</p>	L06	LCD

	Check	Result	Action	Code	Commodity
10.	Substitute a known-good display clamshell and attempt to reproduce the symptom. Is display functionality restored?	Yes	Replace the display clamshell. Verify that the issue is resolved.	L06	LCD
		No	Replace the logic board. Reinstall the user's display clamshell. Use Blank Board Serializer (BBS) to set the computer's serial number. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	M29	MLB
11.	Confirm that the computer display flickering or unstable video issue is resolved. Run ASD or AST Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain. Verify that the issue is resolved. Are all issues resolved?	Yes	The issue is resolved.	\${nodeText.yesSymptomCode}	
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	M03	

Built-in Keyboard Does Not Work Properly

Unlikely causes:

Wireless card, battery, bottom case, display clamshell, fan, flash storage, heat sink, I/O board, power adapter, speakers

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• Key press repeats characters• One or more keys makes abnormal noise when pressed• Sticky keys (stuck in down or up position)• Keys press feels uneven or stiff• Keycap not responding / spongy / not going all the way down• Delayed key return• Keycaps or key switch mechanisms are broken or missing• Keystrokes are not recognized• Keyboard locks up• Displayed characters do not match the keys pressed <p>Note: Inform the user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables.</p>	<ol style="list-style-type: none">1. Check article HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates. Note: You may have to connect an external USB keyboard.2. Press Caps Lock key to see if LED lights up, indicating at least a partial connection to logic board.3. Confirm that correct keyboard layout is selected in System Preferences > Language & Text > Input Sources.4. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.5. Enable Keyboard & Character Viewer In System Preferences > Language & Text > Input Sources. From Input menu in the menu bar, select Show Keyboard Viewer. Check if keystrokes on keyboard are recognized in Keyboard Viewer. If built-in keyboard is not functioning, use an external USB keyboard to perform this step.6. If a key responds abnormally to finger pressure, remove the keycap and inspect underneath for foreign material. Refer to OP120: Portables keycap replacement matrix for how to remove or reinstall a keycap.7. If a keycap is loose, make sure the clasp is intact. If yes, reattach it. If not, refer to OP120: Portables keycap replacement matrix for replacement keycaps.8. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Run Mac Resource Inspector (MRI) or check System Information> Hardware > USB device tree to verify that "Apple Internal Keyboard/Trackpad" is recognized.	Yes	Go to step 2.	<code>#{nodeText.yesSymptomCode}</code>	
	Note: You may have to connect an external USB keyboard. Is Keyboard/Trackpad controller detected?	No	Go to "Built-in Keyboard Not Recognized" troubleshooting flow.	<code>#{nodeText.noSymptomCode}</code>	
2.	Check the keyboard and keycaps for damage. If you discover accidental damage, follow the guidelines listed in article OP14: SERVICE: Determining and quoting accidental damage for Mac portables .	Yes	Go to step 3.	<code>#{nodeText.yesSymptomCode}</code>	
	Are there any damaged keycaps?	No	Go to step 4.	<code>#{nodeText.noSymptomCode}</code>	

	Check	Result	Action	Code	Commodity
3.	1. Refer to OP120: Portables keycap replacement matrix to remove the affected keycap(s). While the keycap is removed, perform the following steps: A. Clean the inner aluminum part of the keycap well to remove any liquid residue that may be present. B. Inspect the switch housing for damage. Keycaps can be replaced, but the switch housing cannot. A damaged switch housing requires replacement of the entire top case.	Yes	Issue resolved by replacing keycap(s). Verify resolution.	`\${nodeText.yesSymptomCode}`	
	2. Refer to OP120: Portables keycap replacement matrix to replace the keycap. Do not reuse keycaps. 3. Test the keycap mechanism to verify that it is functional. Retest the keyboard to verify that all keyboard keys function normally, and the affected keycap or keycaps no longer exhibit this specific symptom. Did this resolve the issue?	No	Replace the top case assembly. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	K27	KEYBOARD
4.	If a Bluetooth keyboard is present and paired with the unit, it may be overriding input commands from the built-in keyboard.	Yes	Go to step 5.	`\${nodeText.yesSymptomCode}`	
	Turn off Bluetooth temporarily to isolate the issue to the built-in keyboard. Does the issue persist with Bluetooth turned off?	No	The issue is isolated to an external accessory. Verify resolution.	`\${nodeText.noSymptomCode}`	
5.	Run AST or AST 2 keyboard test to verify that all keys are functional, including modifier keys.	Yes	Go to step 6.	`\${nodeText.yesSymptomCode}`	
	Does the keyboard pass testing?	No	Go to step 7.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
6.	<p>Start up computer using an up-to-date, bootable macOS volume. See articles HT201314: About macOS Recovery and HT204319: macOS versions and builds included with Mac computers.</p> <p>An external keyboard may be required.</p> <p>Does the issue persist with a known-good OS?</p>	Yes	Go to step 7.	`\${nodeText.yesSymptomCode}`	
		No	Reinstall macOS on the user's computer. Refer to HT204319: macOS versions and builds included with Mac computers to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.	`\${nodeText.noSymptomCode}`	
7.	<p>A liquid spill can short key signals and stop keyboard operations. Visual inspection indicating liquid spills should be very obvious to you and to user.</p> <p>Remove the bottom case and disconnect battery, then check for spills or liquid damage inside the computer. Refer to TP1486: Liquid Contact Indicators for more information about the location of Liquid Contact Indicators inside the computer. Refer to TP1150: Visual/Mechanical Inspection (VMI) Guide for Mac Portables Liquid Damage for guidance.</p> <p>Note: Inform user that computer failures due to accidental damage are not covered, and if applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables.</p> <p>Is liquid damage present on or around the keyboard?</p>	Yes	Go to step 8.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 9.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
8.	Determine whether liquid damage is limited to the top case with keyboard and trackpad, or multiple parts are damaged.	Yes	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair related to liquid spill observation found during repair.	K90	
	Is there liquid damage to multiple parts?	No	Replace the top case assembly. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	K90	KEYBOARD
9.	Disconnect the IPD flex cable from the logic board and trackpad. Disconnect the keyboard flex cable from the trackpad.	Yes	Go to step 10.	`\${nodeText.yesSymptomCode}`	
	Check for damage on the IPD flex cable and the keyboard flex cable, their connectors, and the trackpad and logic board IPD flex connectors. Inspect connector housings. Look for debris or broken/missing pins that might prevent proper seating. Is there damage to any flex cable or connector?	No	Go to step 14.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
10.	Determine whether damage is limited to one of the following components, or multiple parts are damaged: <ul style="list-style-type: none"> • IPD flex cable • Keyboard flex cable (part of top case) • Trackpad • Logic board 	Yes	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	
	Is there damage to multiple parts?	No	Go to step 11.	\${nodeText.noSymptomCode}	
11.	Inspect the IPD flex cable for damage. Pay attention to the body of the cable, looking for pinching, tearing, or crimping, and to both ends of the cable.	Yes	Replace IPD flex cable. Verify that the issue is resolved.	X03	INTERNAL CABLE
	Does the IPD flex cable appear damaged?	No	Go to step 12.	\${nodeText.noSymptomCode}	
12.	Inspect the top case keyboard flex cable connector for damage.	Yes	Replace the top case assembly. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	K16	KEYBOARD
	Does the top case keyboard flex cable connector appear damaged?	No	Go to step 13.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
13.	<p>Inspect the logic board IPD flex cable connector for damage.</p> <p>Does the logic board IPD flex cable connector appear damaged?</p>	Yes	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M24	MLB
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	
14.	<p>Reconnect the keyboard flex cable to the trackpad, ensuring a good connection to the trackpad.</p> <p>Reconnect the IPD flex cable to the logic board and trackpad, ensuring a good connection to both ends.</p> <p>Retest for keyboard functionality.</p> <p>Is the issue resolved?</p>	Yes	Issue resolved by reseating flex cable connections. Verify resolution.	\${nodeText.yesSymptomCode}	
		No	Go to step 15.	\${nodeText.noSymptomCode}	
15.	<p>To completely troubleshoot this issue, a known-good top case is required.</p> <p>Do you have immediate access to a known-good top case?</p>	Yes	Go to step 16.	\${nodeText.yesSymptomCode}	
		No	Go to step 17.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
16.	<p>Substitute a known-good top case.</p> <p>Retest for keyboard functionality.</p> <p>Is the keyboard functioning properly?</p>	Yes	Go to step 17.	`\${nodeText.yesSymptomCode}`	
		No	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M16	MLB
17.	<p>Verify that the specific symptom with the user's built-in keyboard is best described as:</p> <ul style="list-style-type: none"> Sticky keys (stuck in down or up position). <p>Does this specific symptom describe the issue?</p>	Yes	<p>Replace the top case assembly.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	K05	KEYBOARD
		No	Go to step 18.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
18.	<p>Verify that the specific symptom with the user's built-in keyboard is best described as:</p> <ul style="list-style-type: none"> • Keys press feels uneven or stiff. • Keycap not responding / spongy / not going all the way down. • Delayed key return. <p>Does this specific symptom describe the issue?</p>	Yes	<p>Replace the top case assembly.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	K62	KEYBOARD
		No	Go to step 19.	\${nodeText.noSymptomCode}	
19.	<p>Verify that the specific symptom with the user's built-in keyboard is best described as:</p> <ul style="list-style-type: none"> • Key press repeats characters. <p>Does this specific symptom describe the issue?</p>	Yes	<p>Replace the top case assembly.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	K61	KEYBOARD
		No	Go to step 20.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
20.	<p>Verify that the specific symptom with the user's built-in keyboard is best described as:</p> <ul style="list-style-type: none"> One or more keys makes abnormal noise when pressed <p>Does this specific symptom describe the issue?</p>	Yes	<p>Replace the top case assembly.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	K05	KEYBOARD
		No	<p>Replace the top case assembly.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	K01	KEYBOARD
21.	<p>Run AST or AST 2 Keyboard test to verify that all keys are functional after the repair, including the modifier keys.</p> <p>Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Is the issue resolved?</p>	Yes	The issue is resolved. Verify resolution.	\${nodeText.yesSymptomCode}	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	

Built-in Keyboard Has Dim or No Keyboard Backlight

Unlikely causes:

Wireless card, battery, bottom case, fan, flash storage, heat sink, I/O board, power adapter, trackpad

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">All keyboard operation is normal except for backlightKeyboard backlight is not detected in a darkened roomKeyboard backlight is uneven: some keys are dim or one or more keys are brighter than the others <p>Note: Inform the user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables.</p>	<ol style="list-style-type: none">Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates.Check System Preferences > Keyboard to see whether the “Adjust keyboard brightness in low light” option is available and checked. Refer to article HT202310: Portables: Adjust the brightness of your backlit keyboardThe keyboard backlight is enabled only when the ambient light sensor (ALS) detects low light conditions. Check System Preferences > Displays to see whether the “Automatically adjust brightness” / “Automatically adjust brightness as ambient light changes” option is selected.Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.Reset the SMC using the procedure for this computer in article HT201295: Reset the System Management Controller (SMC) on your Mac.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Start up computer using an up-to-date, bootable macOS volume. See articles HT201314: About macOS Recovery and HT204319: macOS versions and builds included with Mac computers . Retest the keyboard backlight. Did the issue persist in a known-good OS?	Yes	Go to step 2.	<code>\$(nodeText.yesSymptomCode)</code>	
		No	Reinstall macOS on the user's computer. Refer to HT204319: macOS versions and builds included with Mac computers to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.	<code>\$(nodeText.noSymptomCode)</code>	
2.	In AST or AST 2, run the Keyboard test suite and verify that the keyboard backlight illuminates at the appropriate part of the test. Does the keyboard backlight pass testing?	Yes	Go to step 13.	<code>\$(nodeText.yesSymptomCode)</code>	
		No	Go to step 3.	<code>\$(nodeText.noSymptomCode)</code>	

	Check	Result	Action	Code	Commodity
3.	<p>A liquid spill can short key signals and stop keyboard operations. Visual inspection indicating liquid spills should be very obvious to you and to user.</p> <p>Remove the bottom case and disconnect battery, then check for spills or liquid damage inside the computer. Refer to TP1486: Liquid Contact Indicators for more information about the location of Liquid Contact Indicators inside the computer. Refer to TP1150: Visual/Mechanical Inspection (VMI) Guide for Mac Portables Liquid Damage for guidance.</p> <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables.</p> <p>Is liquid damage present on or around the keyboard?</p>	Yes	Go to step 4.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 5.	`\${nodeText.noSymptomCode}`	
4.	<p>Determine whether liquid damage is limited to the top case with keyboard and trackpad, or multiple parts are damaged.</p> <p>Is there liquid damage to multiple parts?</p>	Yes	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair related to liquid spill observation found during repair.</p>	K90	
		No	<p>Replace the top case assembly.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	K90	KEYBOARD

	Check	Result	Action	Code	Commodity
5.	Disconnect the IPD flex cable from the logic board and trackpad. Disconnect the keyboard flex cable from the trackpad.	Yes	Go to step 6.	\${nodeText.yesSymptomCode}	
	Check for damage on the IPD flex cable and the keyboard flex cable, their connectors, and the trackpad and logic board IPD flex connectors.	No	Go to step 10.	\${nodeText.noSymptomCode}	
	Inspect connector housings. Look for debris or broken/missing pins that might prevent proper seating.				
	Is there damage to any flex cable or connector?				
6.	Determine whether damage is limited to one of the following components, or multiple parts are damaged: <ul style="list-style-type: none"> • IPD flex cable • Keyboard flex cable (part of top case) • Trackpad • Logic board 	Yes	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	
	Is there damage to multiple parts?	No	Go to step 7.	\${nodeText.noSymptomCode}	
7.	Inspect the IPD flex cable for damage. Pay attention to the body of the cable, looking for pinching, tearing, or crimping, and to both ends of the cable.	Yes	Replace IPD flex cable. Verify that the issue is resolved.	X03	INTERNAL CABLE
	Does the IPD flex cable appear damaged?	No	Go to step 8.	\${nodeText.noSymptomCode}	
8.	Inspect the top case keyboard flex cable connector for damage.	Yes	Replace the top case assembly. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	K16	KEYBOARD
	Does the top case keyboard flex cable connector appear damaged?				
		No	Go to step 9.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
9.	<p>Inspect the logic board IPD flex cable connector for damage.</p> <p>Does the logic board IPD flex cable connector appear damaged?</p>	Yes	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M24	MLB
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	
10.	<p>Reconnect the keyboard flex cable to the trackpad, ensuring a good connection to the trackpad.</p> <p>Reconnect the IPD flex cable to the logic board and trackpad, ensuring a good connection to both ends.</p> <p>Retest for keyboard backlight functionality.</p> <p>Is the issue resolved?</p>	Yes	<p>Issue resolved by reseating flex cable connections. Verify resolution.</p>	\${nodeText.yesSymptomCode}	
		No	<p>Go to step 11.</p>	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
11.	<p>To completely troubleshoot this issue, a known-good top case is required.</p> <p>Do you have immediate access to a known-good top case?</p>	Yes	Go to step 12.	\${nodeText.yesSymptomCode}	
		No	<p>Replace the top case assembly.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	K10	KEYBOARD

	Check	Result	Action	Code	Commodity
12.	Substitute a known-good top case.	Yes	<p>Replace the top case assembly.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	K10	KEYBOARD
	<p>Retest for keyboard backlight functionality.</p> <p>Is the keyboard backlight functioning properly?</p>	No	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M16	MLB
13.	<p>The Ambient Light Sensor (ALS) is located near the camera on top center of the display clamshell.</p> <p>Check ALS functionality by covering the sensor with your hand to simulate a dark room. Check whether the keyboard backlight brightness increases.</p> <p>Keep the ALS covered and use controls to increase the keyboard backlight level.</p>	Yes	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	
	Does the keyboard backlight brightness change?	No	Go to step 14.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
14.	Remove the bottom case and disconnect battery, then disconnect and inspect the camera cable for damage. Look for pinching or crimping, and damaged or bent pins. Does the camera cable show signs of damage?	Yes	Go to step 15.	\${nodeText.yesSymptomCode}	
		No	Go to step 16.	\${nodeText.noSymptomCode}	
15.	Inspect the logic board camera connector for damage. Is the connector on the logic board also damaged?	Yes	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	
		No	Replace the display clamshell. Verify that the issue is resolved.	L14	LCD
16.	Inspect the logic board camera connector for damage. Does the connector on the logic board show signs of damage?	Yes	Replace the logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	M24	MLB
		No	Go to step 17.	\${nodeText.noSymptomCode}	
17.	Reseat the camera cable connection on the logic board. Reseating the cable can restore ALS functionality which can affect the keyboard backlight. Retest for keyboard backlight functionality. Is keyboard backlight functionality restored?	Yes	The issue was resolved by reseating the camera cable. Verify resolution.	\${nodeText.yesSymptomCode}	
		No	Go to step 18.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
18.	To troubleshoot this issue completely, a known-good display clamshell is required.	Yes	Go to step 19.	\${nodeText.yesSymptomCode}	
	Do you have immediate access to a known-good display clamshell?	No	Replace the display clamshell. Verify that the issue is resolved.	L17	LCD
19.	Substitute a known-good display clamshell.	Yes	Replace the display clamshell.	L17	LCD
	Retest for keyboard backlight functionality.		Verify that the issue is resolved.		
	Is keyboard backlight functionality restored?	No	Go to step 20.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
20.	<p>Of the two issues below, determine which issue best describes the primary symptom:</p> <ul style="list-style-type: none"> A - Keyboard backlight is not detected in a darkened room B - Keyboard backlight is uneven: some keys are dim or one or more keys are brighter than the others <p>Which issue describes the primary symptom?</p>	A	<p>Replace the logic board.</p> <p>Reinstall user's display clamshell.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M16	MLB
		B	<p>Replace the top case assembly.</p> <p>Reinstall user's display clamshell.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	K28	KEYBOARD
21.	<p>Restart the computer and verify that the keyboard backlight is functioning normally.</p> <p>Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Are all issues resolved?</p>	Yes	The issue is resolved.	\${nodeText.yesSymptomCode}	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	

Built-in Keyboard or Trackpad Not Recognized

Unlikely causes:

Wireless card, battery, bottom case, display clamshell, fan, flash storage, heat sink, I/O board, power adapter, speakers

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">No key is recognized except power button.Caps Lock LED does not light up when pressed.Keyboard, or trackpad, or both, is not recognized. <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables.</p>	<ol style="list-style-type: none">Press Caps Lock key to see if LED lights up, indicating at least a partial connection to logic board.Use external USB keyboard and mouse and check for built-in keyboard and trackpad functionality.Enable Keyboard & Character Viewer In System Preferences > Language & Text > Input Sources. From Input menu in the menu bar, select Show Keyboard Viewer. Check if keystrokes on keyboard are recognized in Keyboard Viewer. If built-in keyboard is not functioning, use an external USB keyboard to perform this step.Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.Check article HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates. Note: You may have to connect an external USB keyboard.If the trackpad is also not working, check System Information > Hardware > USB to see if “Apple Internal Keyboard / Trackpad” is listed. Use an external USB mouse, if needed, to access System Information.Reset the SMC using the procedure for this computer in article HT201295: Reset the System Management Controller (SMC) on your Mac.Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Start up computer using an up-to-date, bootable macOS volume. See articles HT201314: About macOS Recovery and HT204319: macOS versions and builds included with Mac computers .	Yes	Reinstall macOS on the user's computer. Refer to HT204319: macOS versions and builds included with Mac computers to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.	\$(nodeText.yesSymptomCode)	
	Retest the keyboard backlight. Do keyboard and trackpad both function with known-good OS?	No	Go to step 2.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
2.	Run Mac Resource Inspector (MRI) or check System Information > Hardware > SPI tree to verify that "Apple Internal Keyboard/Trackpad" is recognized. Note: You may have to connect a mouse and an Apple USB Ethernet Adapter to an external USB keyboard then connect keyboard to the computer to get simultaneous keyboard, trackpad, and network access. Is Apple Internal Keyboard/Trackpad controller detected?	Yes	Go to step 3.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 8.	`\${nodeText.noSymptomCode}`	
3.	Restart the computer and hold down the Option (Alt) key during startup. After a few seconds, Startup Manager should appear. Does computer boot to Startup Manager?	Yes	Go to step 4.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 8.	`\${nodeText.noSymptomCode}`	
4.	Test the trackpad by attempting to move the cursor while in Startup Manager. Does trackpad function while in Startup Manager?	Yes	Go to step 5.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 8.	`\${nodeText.noSymptomCode}`	
5.	Remove the bottom case and disconnect battery. Disconnect the keyboard flex cable from the trackpad. Check for damage on the keyboard flex cable, its connectors, and the trackpad and logic board IPD flex connectors. Inspect connector housings. Look for debris or broken/missing pins that might prevent proper seating. Reconnect the keyboard flex cable to the trackpad, ensuring a good connection from the top case to the trackpad. Retest for keyboard and trackpad functionality. Does the keyboard now function?	Yes	Issue resolved by reseating keyboard flex cable. Verify resolution.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 6.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
6.	<p>To completely troubleshoot this issue, a known-good trackpad is required.</p> <p>Do you have immediate access to a known-good trackpad?</p>	Yes	Go to step 7.	\${nodeText.yesSymptomCode}	
		No	<p>Replace the trackpad.</p> <p>Reinstall user's IPD flex cable.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	K11	MOUSE

	Check	Result	Action	Code	Commodity
7.	Substitute a known-good trackpad and retest.	Yes	<p>Replace the trackpad.</p> <p>Reinstall user's IPD flex cable.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	K11	MOUSE
	Does the keyboard now function?	No	<p>Replace the top case assembly.</p> <p>Reinstall user's trackpad.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	K11	KEYBOARD
8.	Remove the bottom case and disconnect battery. Disconnect the IPD flex cable from the logic board and trackpad. Disconnect the keyboard flex cable from the trackpad.	Yes	Go to step 9.	`\${nodeText.yesSymptomCode}`	
	<p>Check for damage on the IPD flex cable and the keyboard flex cable, their connectors, and the trackpad and logic board IPD flex connectors.</p> <p>Inspect connector housings. Look for debris or broken/missing pins that might prevent proper seating.</p> <p>Is there damage to any flex cable or connector?</p>	No	Go to step 13.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
9.	Determine whether damage is limited to one of the following components, or multiple parts are damaged: <ul style="list-style-type: none"> • IPD flex cable • Keyboard flex cable (part of top case) • Trackpad • Logic board 	Yes	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	
	Is there damage to multiple parts?	No	Go to step 10.	\${nodeText.noSymptomCode}	
10.	Inspect the IPD flex cable for damage. Pay attention to the body of the cable, looking for pinching, tearing, or crimping, and to both ends of the cable.	Yes	Replace IPD flex cable. Verify that the issue is resolved.	X03	INTERNAL CABLE
	Does the IPD flex cable appear damaged?	No	Go to step 11.	\${nodeText.noSymptomCode}	
11.	Inspect the top case keyboard flex cable connector for damage.	Yes	Replace the top case assembly. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	K16	KEYBOARD
	Does the top case keyboard flex cable connector appear damaged?		Go to step 12.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
12.	<p>Inspect the logic board IPD flex cable connector for damage.</p> <p>Does the logic board IPD flex cable connector appear damaged?</p>	Yes	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M24	MLB
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	
13.	<p>Reconnect the keyboard flex cable to the trackpad, ensuring a good connection to the trackpad.</p> <p>Reconnect the IPD flex cable to the logic board and trackpad, ensuring a good connection to both ends.</p> <p>Retest for keyboard and trackpad functionality.</p> <p>Is the issue resolved?</p>	Yes	Issue resolved by reseating flex cable connections. Verify resolution.	<p> <code> \${nodeText.yesSymptomCode} </code> </p>	
		No	Go to step 14.	<p> <code> \${nodeText.noSymptomCode} </code> </p>	
14.	<p>To completely troubleshoot this issue, a known-good IPD flex cable is required.</p> <p>Do you have immediate access to a known-good IPD flex cable?</p>	Yes	Go to step 15.	<p> <code> \${nodeText.yesSymptomCode} </code> </p>	
		No	<p>Replace IPD flex cable.</p> <p>Verify that the issue is resolved.</p>	X03	INTERNAL CABLE
15.	<p>Substitute a known-good IPD flex cable and retest.</p> <p>Do the keyboard and trackpad now function?</p>	Yes	<p>Replace IPD flex cable.</p> <p>Verify that the issue is resolved.</p>	X03	INTERNAL CABLE
		No	Go to step 16.	<p> <code> \${nodeText.noSymptomCode} </code> </p>	

	Check	Result	Action	Code	Commodity
16.	<p>To completely troubleshoot this issue, a known-good trackpad is required.</p> <p>Do you have immediate access to a known-good trackpad?</p>	Yes	Go to step 17.	`\${nodeText.yesSymptomCode}`	
		No	<p>Replace the trackpad.</p> <p>Reinstall user's IPD flex cable.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	K15	MOUSE
17.	<p>Substitute a known-good trackpad and retest.</p> <p>Do the keyboard and trackpad now function?</p>	Yes	<p>Replace the trackpad.</p> <p>Reinstall user's IPD flex cable.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	K15	MOUSE
		No	Go to step 18.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
18.	<p>To completely troubleshoot this issue, a known-good logic board is required.</p> <p>Do you have immediate access to a known-good logic board?</p>	Yes	Go to step 19.	\${nodeText.yesSymptomCode}	
		No	<p>Replace the logic board.</p> <p>Reinstall user's trackpad and IPD flex cable.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M16	MLB

	Check	Result	Action	Code	Commodity
19.	Substitute a known-good logic board and retest. Do the keyboard and trackpad now function?	Yes	Replace the logic board. Reinstall user's trackpad and IPD flex cable. Use Blank Board Serializer (BBS) to set the computer's serial number. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	M16	MLB
		No	Replace the top case assembly. Reinstall user's logic board, trackpad, and IPD flex cable. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	K11	KEYBOARD

	Check	Result	Action	Code	Commodity
20.	Verify that both the keyboard and trackpad are now functioning properly.	Yes	The issue is resolved. Verify resolution.	#{nodeText.yesSymptomCode}	
	<p>Run AST or AST 2 Keyboard test to verify that all keys are functional after the repair, including the modifier keys.</p> <p>Run AST or AST 2 Trackpad test to verify that the trackpad is functional after the repair.</p> <p>Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Is the issue resolved?</p>	No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	

Built-in Trackpad Does Not Track Properly

Unlikely causes:

Wireless card, bottom case, display clamshell, fan, flash storage, heat sink, I/O board, power adapter, speakers, top case

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">Cursor does not move with trackpad input.Multi-Touch features are inoperable.Trackpad is not responding to clicks. <p>Note: Inform the user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables.</p>	<ol style="list-style-type: none">1. Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model. The trackpad will not function properly with an older build of macOS. Check for and apply the latest software and firmware updates. Note: You may have to connect a mouse and an external USB keyboard.2. Check for environmental factors such as humidity, hand lotion, or jewelry. Check to see whether the user is touching the trackpad simultaneously with both hands.3. With the computer off, clean the trackpad surface using a clean, dry, lint-free cloth.4. In System Preferences > Accessibility/Universal Access, disable all assisted “Keyboard” and “Mouse & Trackpad” settings. Retest trackpad functionality.5. In System Preferences > Trackpad, check and adjust Trackpad speed. Settings too high or low may be perceived as trackpad issues.6. Disconnect all Bluetooth devices. In System Preferences > Bluetooth, click the ‘X’ button next to every device.7. Start up from known-good, up-to-date, bootable macOS volume to verify the issue.8. If the issue occurs when the computer is running from a power adapter, try using a three-prong power cable rather than a two-prong duckhead.9. If the issue persists with a three-prong power cable, refer to article HT203146: Intel-based Mac notebooks: Troubleshooting unresponsive trackpad issues for further instructions.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Verify that the trackpad button depresses normally when pressed.	Yes	Go to step 3.	<code>\$(nodeText.yesSymptomCode)</code>	
	Is trackpad button depressing normally?	No	Go to step 2.	<code>\$(nodeText.noSymptomCode)</code>	
2.	If the trackpad button behaves as if it is being pressed continuously, a swollen battery may be preventing the trackpad button from releasing. Remove the battery and verify whether trackpad button functionality returns.	Yes	Go to “Battery Leaking or Swollen” troubleshooting flow.	<code>\$(nodeText.yesSymptomCode)</code>	
	Does trackpad button behave normally once battery is removed?	No	Go to step 6.	<code>\$(nodeText.noSymptomCode)</code>	

	Check	Result	Action	Code	Commodity
3.	Run Mac Resource Inspector (MRI) or check System Information > Hardware > USB device tree to verify that "Apple Internal Keyboard / Trackpad" is recognized. Note: You may have to connect a mouse and an external USB keyboard. Is Keyboard / Trackpad controller detected?	Yes	Go to step 4.	`\${nodeText.yesSymptomCode}`	
		No	Go to "Built-in Keyboard or Trackpad Not Recognized" troubleshooting flow.	`\${nodeText.noSymptomCode}`	
4.	Run AST 2 Trackpad Diagnostic The diagnostic is multi-touch capable, and will instruct you to touch every part of the trackpad surface to verify surface multi-touch functionality of the trackpad. Does Trackpad Diagnostic pass?	Yes	Go to step 5.	`\${nodeText.yesSymptomCode}`	
		No	Replace the trackpad. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	K12	MOUSE
5.	Start up computer using an up-to-date, bootable macOS volume. See articles HT201314: About macOS Recovery and HT204319: macOS versions and builds included with Mac computers . Attempt to reproduce the trackpad issue. Does issue persist with known-good OS?	Yes	Go to step 6.	`\${nodeText.yesSymptomCode}`	
		No	Reinstall macOS on the user's computer. Refer to HT204319: macOS versions and builds included with Mac computers to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
6.	<p>A previous step asked whether the trackpad button depressed normally when pressed. Confirm that trackpad button behaves as expected.</p> <p>Is trackpad button depressing normally?</p>	Yes	<p>Replace the trackpad.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	K12	MOUSE
		No	Go to step 7.	\${nodeText.noSymptomCode}	
7.	<p>Check for proper trackpad alignment and verify that the click-depth set screw is at its factory setting. Adjust setting if needed.</p> <p>Does trackpad button behave normally after set screw adjustment?</p>	Yes	Issue resolved by adjusting the trackpad set screw. Verify resolution.	\${nodeText.yesSymptomCode}	
		No	<p>Replace the trackpad.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	K13	MOUSE
8.	<p>Run AST or AST 2 Trackpad and Keyboard tests to verify that both are functional after the repair.</p> <p>Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Is the issue resolved?</p>	Yes	The issue is resolved. Verify resolution.	\${nodeText.yesSymptomCode}	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	

Camera Issues

Unlikely causes:

Wireless card, battery, bottom case, fan, flash storage, heat sink, speakers, top case, trackpad

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• Camera not detected• No green LED for camera• Excessive blooming in camera image• Poor white balance• Poor focus• Distorted/discolored image• Failure to respond to changing ambient light conditions <p>Note: Inform the user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables.</p>	<ol style="list-style-type: none">1. Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model. The camera may not function properly with an older build of macOS. Check for and apply the latest software and firmware updates.2. Verify camera lens and glass panel are clear of contaminants.3. Ask the user about lighting conditions in his or her working environment. Dim lighting causes poor image quality. Overly bright lighting can bounce off surfaces onto the subject and make the image foggy.4. Striped, textured, and mesh clothing can create moiré patterns in image.5. Disconnect all peripheral devices and restart computer.6. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.7. Reset SMC using procedure for this computer in article HT201295: Reset the System Management Controller (SMC) on your Mac.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Check Mac Resource Inspector (MRI) results to verify that the camera is detected. If AST or AST 2 is not available, go to System Information > USB to verify that the FaceTime HD Camera is recognized. Does MRI or System Information detect the camera?	Yes	Go to step 2.	\$(nodeText.yesSymptomCode)	
		No	Go to step 4.	\$(nodeText.noSymptomCode)	
2.	Launch Photo Booth. Verify that the green LED next to the camera lights up. Does the camera LED light up?	Yes	Go to step 3.	\$(nodeText.yesSymptomCode)	
		No	Go to step 4.	\$(nodeText.noSymptomCode)	
3.	Verify that the camera image is clear and undistorted. Is the image clear?	Yes	The issue cannot be duplicated.	\$(nodeText.yesSymptomCode)	
		No	Replace the display assembly. Verify that the issue is resolved.	L17	LCD

	Check	Result	Action	Code	Commodity
4.	<p>Start up computer using an up-to-date, bootable macOS volume. See articles HT201314: About macOS Recovery and HT204319: macOS versions and builds included with Mac computers.</p> <p>Retest the camera.</p> <p>Does the camera function properly in a known-good OS?</p>	Yes	<p>Reinstall macOS on the user's computer. Refer to HT204319: macOS versions and builds included with Mac computers to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.</p>	\$(nodeText.yesSymptomCode)	
		No	Go to step 5.	\$(nodeText.noSymptomCode)	
5.	<p>Remove the bottom case and disconnect battery, then disconnect and inspect the camera cable for damage. Look for pinching or crimping, and damaged or bent pins.</p> <p>Does the camera cable show signs of damage?</p>	Yes	Go to step 6.	\$(nodeText.yesSymptomCode)	
		No	Go to step 7.	\$(nodeText.noSymptomCode)	
6.	<p>Inspect the logic board camera connector for damage.</p> <p>Is the connector on the logic board also damaged?</p>	Yes	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	
		No	<p>Replace the display clamshell. Verify that the issue is resolved.</p>	L14	LCD

	Check	Result	Action	Code	Commodity
7.	Inspect the logic board camera connector for damage. Does the connector on the logic board show signs of damage?	Yes	Replace the logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	M24	MLB
		No	Go to step 8.	\$(nodeText.noSymptomCode)	
8.	Reseat the camera cable securely to the logic board.	Yes	Go to step 9.	\$(nodeText.yesSymptomCode)	
	Run Mac Resource Inspector (MRI) and check test results to verify camera presence. Does MRI detect the camera?	No	Go to step 10.	\$(nodeText.noSymptomCode)	
9.	Launch Photo Booth. Verify that the green LED next to the camera lights up. Make sure the image looks normal.	Yes	The issue was resolved by reseating the camera cable. Verify resolution.	\$(nodeText.yesSymptomCode)	
	Does the camera LED light up and the image appear normal?	No	Go to step 10.	\$(nodeText.noSymptomCode)	
10.	To completely troubleshoot this issue, a known-good display clamshell is required.	Yes	Go to step 11.	\$(nodeText.yesSymptomCode)	
	Do you have immediate access to a known-good display clamshell?	No	Replace the display clamshell. Verify that the issue is resolved.	L17	LCD

	Check	Result	Action	Code	Commodity
11.	<p>Substitute a known-good display clamshell to test camera output.</p> <p>Run Mac Resource Inspector (MRI) and check test results to verify camera presence.</p> <p>Does MRI detect the camera?</p>	Yes	Go to step 12.	\$(nodeText.yesSymptomCode)	
		No	<p>Replace the logic board.</p> <p>Reinstall the user's display clamshell.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M13	MLB
12.	<p>Launch Photo Booth. Verify that the green LED next to the camera lights up. Make sure the image looks normal.</p> <p>Does the camera LED light up and the image appear normal?</p>	Yes	<p>Replace the display clamshell.</p> <p>Verify that the issue is resolved.</p>	L17	LCD
		No	<p>Replace the logic board.</p> <p>Reinstall the user's display clamshell.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M13	MLB

	Check	Result	Action	Code	Commodity
13.	Restart the computer and verify that the image from the camera, the display image and backlight, and the ambient light sensor are functioning normally.	Yes	The issue is resolved. Verify resolution.	\${nodeText.yesSymptomCode}	
	<p>Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Are all issues resolved?</p>	No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	

Distorted Audio from Internal Speaker(s)

Unlikely causes:

Wireless card, battery, bottom case, display clamshell, fan, flash storage, heat sink, power adapter, top case, trackpad

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• Sound is distorted, fuzzy, crackly, etc.• Symptom only appears in internal speaker• Symptom also appears in external speakers/headphones <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables.</p>	<ol style="list-style-type: none">1. Test with a known-good sound file.2. Compare the same sound and settings against a known-good computer of the same type to confirm that the sound is distorting.3. In System Preferences > Sound > Output, adjust the Output volume and use the balance slider to isolate the left and right speakers.4. If testing using iTunes, check that the equalizer is not turned on.5. Test the audio output using more than one application or website.6. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.7. Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Start up computer using an up-to-date, bootable macOS volume. See articles HT201314: About macOS Recovery and HT204319: macOS versions and builds included with Mac computers . Retest for speaker or headphone jack audio issue. Does the audio issue persist in a known-good OS?	Yes	Go to step 2.	\$(nodeText.yesSymptomCode)	
		No	Reinstall macOS on the user's computer. Refer to HT204319: macOS versions and builds included with Mac computers to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.	\$(nodeText.noSymptomCode)	
2.	Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac . In System Preferences > Sound > Output, adjust Output volume and retest. Play audio through internal speakers and known-good headphones or external speakers. Is audio clear and distortion free through internal speakers and headphones/external speakers?	Yes	Issue resolved. Verify resolution.	\$(nodeText.yesSymptomCode)	
		No	Go to step 3.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
3.	Play a known-good audio file on internal speakers, then connect known-good headphones or external speakers and compare for distortion. Is the issue isolated to the internal speakers?	Yes	Go to step 13.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 4.	`\${nodeText.noSymptomCode}`	
4.	Remove the bottom case and disconnect battery. Disconnect the input/output (I/O) flex cable from the logic board and the I/O board. Inspect the cable and connectors for damage. Look for pinching or crimping, and damaged or bent pins. Does the I/O flex cable show signs of damage?	Yes	Go to step 5.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 6.	`\${nodeText.noSymptomCode}`	
5.	Inspect the logic board and I/O board, I/O connectors for damage. Is the connector on the logic board or I/O board also damaged?	Yes	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	
		No	Replace the I/O flex cable. Verify that the issue is resolved.	X03	INTERNAL CABLE
6.	While the I/O flex cable is removed, disconnect the I/O power cable from the logic board. Inspect the cable and connector for damage. Look for pinching or crimping, and damaged or bent pins. Does the I/O power cable show signs of damage?	Yes	Replace the I/O board. Verify that the issue is resolved.	M24	OTHER BOARD
		No	Go to step 7.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
7.	<p>Inspect the logic board I/O flex cable and power cable connectors for damage.</p> <p>Does either connector on the logic board show signs of damage?</p>	Yes	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M24	MLB
		No	Go to step 8.	\$(nodeText.noSymptomCode)	
8.	<p>Inspect the I/O board I/O flex cable connector for damage.</p> <p>Does the connector on the I/O board show signs of damage?</p>	Yes	<p>Replace the I/O board.</p> <p>Verify that the issue is resolved.</p>	M24	OTHER BOARD
		No	Go to step 9.	\$(nodeText.noSymptomCode)	
9.	<p>Reseat the I/O board flex cable and power cable connections to the logic board and I/O board.</p> <p>Retest for audio issue.</p> <p>Is internal/external sound now audible, clear, and free of distortion?</p>	Yes	<p>Issue resolved by reseating the I/O flex cable or power cable.</p> <p>Verify that the issue is resolved.</p>	\$(nodeText.yesSymptomCode)	
		No	Go to step 10.	\$(nodeText.noSymptomCode)	
10.	<p>To completely troubleshoot this issue, the following known-good parts are required.</p> <ul style="list-style-type: none"> I/O flex cable I/O board <p>Do you have immediate access to each of these known-good parts?</p>	Yes	Go to step 11.	\$(nodeText.yesSymptomCode)	
		No	<p>Replace the I/O flex cable.</p> <p>Verify that the issue is resolved.</p>	X03	INTERNAL CABLE
11.	<p>Substitute a known-good I/O flex cable.</p> <p>Retest for audio issue.</p> <p>Is internal/external sound now audible, clear, and free of distortion?</p>	Yes	<p>Replace the I/O flex cable.</p> <p>Verify that the issue is resolved.</p>	X09	INTERNAL CABLE
		No	Go to step 12.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
12.	Substitute a known-good I/O board. Retest for audio issue. Is internal/external sound now audible, clear, and free of distortion?	Yes	Replace the I/O board. Reinstall user's I/O flex cable. Verify that the issue is resolved.	M09	OTHER BOARD
		No	Replace the logic board. Reinstall user's I/O flex cable and I/O board. Use Blank Board Serializer (BBS) to set the computer's serial number. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	M09	MLB
13.	Disconnect headphones/external speakers. Run AST 2 Audio Test to verify left and right speakers produce expected audio test patterns from each speaker. Refer to article TP587: Using Audio Test . Does unit pass AST 2 Audio Test?	Yes	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	
		No	Go to step 14.	\${nodeText.noSymptomCode}	
14.	Remove the bottom case and disconnect battery. Inspect the cables that connect the left and right speakers to the logic board and I/O board. Check for damage to either cable, its connectors, and the logic board and I/O board connectors. Did you find damage to either cable, or logic board or I/O board connectors?	Yes	Go to step 15.	\${nodeText.yesSymptomCode}	
		No	Go to step 16.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
15.	The speaker flex cables are part of each speaker, and both speakers must be replaced as a matched pair.	Yes	Speakers are replaced as a matched set. Replace speakers with a matched-pair replacement kit. Verify that the issue is resolved.	X03	OTHER ELECTRIC
	Determine whether damage is on the logic board, either speaker, or both. Is the damage limited to speaker?	No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	
16.	Reconnect the speaker cables to the logic board and I/O board, ensuring a good connection. Run AST 2 Audio Test to verify left and right speakers produce expected audio test patterns from each speaker.	Yes	The issue was resolved by reseating the speaker flex cables. Verify that the issue is resolved.	`\${nodeText.yesSymptomCode}`	
	Refer to article TP587: Using Audio Test . Does unit pass AST 2 Audio Test?	No	Go to step 17.	`\${nodeText.noSymptomCode}`	
17.	To fully troubleshoot this issue, a known-good left and right speaker pair is required. Do you have immediate access to known-good left and right speakers?	Yes	Go to step 18.	`\${nodeText.yesSymptomCode}`	
		No	Speakers are replaced as a matched set. Replace speakers with a matched-pair replacement kit. Verify that the issue is resolved.	X09	OTHER ELECTRIC
18.	Substitute a known-good left and right speaker pair and retest the audio. Is the issue resolved by known-good left and right speakers?	Yes	Speakers are replaced as a matched set. Replace speakers with a matched-pair replacement kit. Verify that the issue is resolved.	X09	OTHER ELECTRIC
		No	Go to step 19.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
19.	<p>The left speaker is connected to the I/O board. The right speaker is connected to the logic board.</p> <p>Isolate which speaker has distorted sound. If both speakers have distorted sound, select "Both."</p> <p>Which speaker has distorted sound?</p>	Left	<p>Replace the I/O board.</p> <p>Verify that the issue is resolved.</p>	M09	OTHER BOARD
		Right or Both	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run AST 2 Trackpad Calibration Check to verify the proper functionality of the trackpad, as well as recalibrate it if necessary.</p> <p>Refer to TP1314: Trackpad Calibration Check for instructions.</p> <p>Verify the issue is resolved.</p>	M09	MLB
20.	<p>Connect and disconnect headphones/external speakers. Verify that audio can be played through both external and internal speakers, and that sound is clear and free of distortion.</p> <p>Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Is the issue resolved?</p>	Yes	The issue is resolved. Verify resolution.	\$(nodeText.yesSymptomCode)	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	

External Apple Bluetooth Peripherals

Unlikely causes:

There are no unlikely causes for this issue.

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• Apple Bluetooth wireless keyboard, mouse, or trackpad is not recognized by known-good computer• Apple Bluetooth wireless keyboard, mouse, or trackpad will not pair with known-good computer• Apple Bluetooth wireless keyboard, mouse, or trackpad intermittently loses its connection• Apple wireless keyboard has one or more of the following issues:<ul style="list-style-type: none">◦ No power◦ Battery will not charge (for peripherals with embedded batteries)◦ Swollen battery (for peripherals with embedded batteries)◦ Battery runtime too short◦ Will not turn off◦ Specific key(s) do not work◦ Keys seem to stick, do not respond properly, or respond slowly◦ Wrong keyboard language◦ Keys missing or falling off keyboard◦ Paint is wearing off of one or more keys on the keyboard◦ Physical and/or cosmetic issues• Apple wireless mouse has one or more of the following issues:<ul style="list-style-type: none">◦ No power◦ Battery will not charge (for peripherals with embedded batteries)◦ Swollen battery (for peripherals with embedded batteries)◦ Battery runtime too short◦ Will not turn off◦ No mouse response◦ Mouse click not recognized◦ Mouse causes erratic cursor tracking◦ Physical and/or cosmetic issues• Apple wireless trackpad has one or more of the following issues:<ul style="list-style-type: none">◦ No power◦ Battery will not charge (for peripherals with embedded batteries)◦ Swollen battery (for peripherals with embedded batteries)◦ Battery runtime too short◦ Will not turn off◦ No trackpad response◦ Trackpad click not recognized◦ Trackpad causes erratic cursor tracking◦ Trackpad requires high click force◦ Trackpad click overly sensitive◦ Force Touch or haptic feedback issue◦ Physical and/or cosmetic issues <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<p>IMPORTANT: This troubleshooting procedure is intended only for Apple Bluetooth wireless peripheral devices, such as the following Apple products:</p> <ul style="list-style-type: none">• Magic Mouse or Magic Mouse 2• Magic Trackpad or Magic Trackpad 2• Apple Wireless Keyboard or Magic Keyboard <p>For simplicity, this procedure refers to these products as wireless mouse, wireless trackpad, and wireless keyboard unless otherwise noted.</p> <p>For third-party devices, contact the manufacturer for support, software/firmware updates, or service options.</p> <ol style="list-style-type: none">1. Check for and apply the latest software and firmware updates.2. In System Preferences, make sure Bluetooth is on and set to Discoverable.3. For Apple Bluetooth peripherals with replaceable batteries, such as the Magic Mouse, Magic Trackpad, or Apple Wireless Keyboard: If the device does not turn on, then install new or freshly charged batteries.4. For Apple Bluetooth peripherals with embedded batteries, such as the Magic Mouse 2, Magic Trackpad 2, or Magic Keyboard: If the device does not turn on, then connect a known-good USB Power Adapter and Lightning cable to the device to charge it for at least two minutes. Switching the device power button or switch to the ON position will allow the device to charge more quickly than when OFF.5. For Apple Bluetooth peripherals with embedded batteries such as the Magic Mouse 2, Magic Trackpad 2, or Magic Keyboard, verify that the computer being used with the peripheral supports Bluetooth 4.0 or later. Computers with earlier versions of Bluetooth support will not pair with Apple Bluetooth peripherals with embedded batteries.6. Reset Bluetooth device or delete pairing (if applicable).7. If Bluetooth pairs normally at your service location, then research potential sources of interference in the user's environment, such as microwave ovens or cordless phones in the 2.4/5GHz range. See article HT201542: Potential sources of Wi-Fi and Bluetooth interference.8. Magic Mouse 2, Magic Trackpad 2, and Magic Keyboard, can pair with the computer using either Bluetooth or a Lightning cable. If Bluetooth pairing is not possible due to interference or other reasons, then try pairing these products by connecting them to the known-good computer with a known-good Lightning cable.9. Follow steps listed in HT204066: Use Bluetooth Diagnostics to help you isolate issues with wireless devices.10. For keyboard issues, refer to HT204540: If your Apple keyboard doesn't work for troubleshooting tips.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	<p>Visually inspect the user's wireless mouse, wireless trackpad, or wireless keyboard for any for physical, cosmetic, and/or liquid damage.</p> <p>On a wireless mouse or wireless trackpad, verify that the mouse or trackpad button clicks.</p> <p>On keyboards, verify that all keyboard buttons are present and can be depressed normally.</p> <p>Does the user's wireless mouse, wireless trackpad, or wireless keyboard show signs of damage?</p>	Yes	Go to step 2.	\$(nodeText.yesSymptomCode}	
		No	Go to step 11.	\$(nodeText.noSymptomCode}	
2.	<p>Determine whether there is a safety issue, such as fumes, excessive heat, or shock.</p> <p>Do not perform procedures that can be a safety risk to you or the user.</p> <p>Can you proceed safely?</p>	Yes	Go to step 3.	\$(nodeText.yesSymptomCode}	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support regarding safety procedures for this product.</p>	\$(nodeText.noSymptomCode}	
3.	<p>Isolate damage issue to either user's wireless keyboard, or wireless mouse or trackpad.</p> <p>Which peripheral is damaged?</p>	Wireless keyboard	Go to step 4.	\$(nodeText.yesSymptomCode}	
		Wireless mouse or trackpad	Go to step 8.	\$(nodeText.noSymptomCode}	
4.	<p>Closely examine the user's device to determine exact nature of the issue.</p> <p>Look for any signs of liquid spill, liquid penetration, or liquid damage to device.</p> <p>Is damage to user's device related to liquid spill?</p>	Yes	Replace the user's wireless keyboard out of warranty.	K90	KEYBOARD
		No	Go to step 5.	\$(nodeText.noSymptomCode}	
5.	<p>Closely examine the user's device for any signs of physical damage that may affect operation.</p> <p>Does the user's device exhibit this symptom?</p>	Yes	Replace the user's wireless keyboard out of warranty.	K16	KEYBOARD
		No	Go to step 6.	\$(nodeText.noSymptomCode}	
6.	<p>Closely examine the user's device for signs of paint wearing off of one or more keys.</p> <p>Does the user's device exhibit this symptom?</p>	Yes	Replace the user's wireless keyboard out of warranty.	K35	KEYBOARD
		No	Go to step 7.	\$(nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
7.	Closely examine the user's device for any signs of cosmetic damage that does not affect operation.	Yes	Replace the user's wireless keyboard out of warranty.	K21	KEYBOARD
	Does the user's device exhibit this symptom?	No	Issue cannot be duplicated.	\$(nodeText.noSymptomCode)	
8.	Closely examine the user's device to determine exact nature of the issue.	Yes	Replace the user's wireless mouse or wireless trackpad out of warranty.	K90	MOUSE
	Look for any signs of liquid spill, liquid penetration, or liquid damage to device.	No	Go to step 9.	\$(nodeText.noSymptomCode)	
	Is damage to user's device related to liquid spill?				
9.	Closely examine the user's device for any signs of physical damage that may affect operation.	Yes	Replace the user's wireless mouse or wireless trackpad out of warranty.	K16	MOUSE
	Does the user's device exhibit this symptom?	No	Go to step 10.	\$(nodeText.noSymptomCode)	
10.	Closely examine the user's device for any signs of cosmetic damage that does not affect operation.	Yes	Replace the user's wireless mouse or wireless trackpad out of warranty.	K21	MOUSE
	Does the user's device exhibit this symptom?	No	Issue cannot be duplicated.	\$(nodeText.noSymptomCode)	
11.	Follow steps listed in HT201171: Using a Bluetooth mouse, keyboard, or trackpad with your Mac to pair the user's Bluetooth device with a known-good Mac.	Yes	ESCALATION REQUIRED. The Bluetooth device appears to be performing to specifications. There may be an issue with the user's computer, or wireless interference in user's environment. If issue persists, then contact ACS for additional support.	\$(nodeText.yesSymptomCode)	
	Test the user's wireless mouse, wireless trackpad, or wireless keyboard manually, using built-in applications on a known-good Mac. For example, use the Notes application to check the keys on a wireless keyboard.				
	Refer to HT204621: If your Apple wireless mouse, keyboard, or trackpad aren't working as expected for tips to resolve issues.				
12.	Does the user's wireless mouse, wireless trackpad, or wireless keyboard pair and function normally?	No	Go to step 12.	\$(nodeText.noSymptomCode)	
	Isolate failure to either user's wireless keyboard, or wireless mouse or trackpad.	Wireless keyboard	Go to step 13.	\$(nodeText.yesSymptomCode)	
	Which peripheral is malfunctioning?	Wireless mouse or trackpad	Go to step 29.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
13.	Look for for any signs of power on the user's wireless keyboard, such as a power LED turning on. Note: Not all devices have a power LED.	Yes	Go to step 14.	\${nodeText.yesSymptomCode}	
	Verify that the user's wireless keyboard turns ON when the power button or switch is placed in the ON position. Verify that the user's wireless keyboard turns OFF when the power button or switch is placed in the OFF position. Does the user's wireless keyboard exhibit any power-related symptoms?	No	Go to step 18.	\${nodeText.noSymptomCode}	
14.	Confirm that the issue with the user's wireless keyboard is: <ul style="list-style-type: none"> User's wireless keyboard is not functioning at all (seems dead, no power, power LED does not turn on) 	Yes	Replace the user's wireless keyboard. Verify that the issue is resolved.	K09	KEYBOARD
	Does the user's wireless keyboard exhibit this symptom?	No	Go to step 15.	\${nodeText.noSymptomCode}	
15.	Verify that the user's wireless keyboard turns ON when the power button or switch is placed in the ON position. Confirm that the issue with the user's wireless keyboard is: <ul style="list-style-type: none"> Power switch or button is defective 	Yes	Replace the user's wireless keyboard. Verify that the issue is resolved.	K19	KEYBOARD
	Does the user's wireless keyboard exhibit this symptom?	No	Go to step 16.	\${nodeText.noSymptomCode}	
16.	Verify that the user's wireless keyboard turns off when the power button or switch is placed in the OFF position. Confirm that the issue with the user's wireless keyboard is:	Yes	Replace the user's wireless keyboard. Verify that the issue is resolved.	K34	KEYBOARD
	<ul style="list-style-type: none"> User's wireless keyboard remains ON when power button or switch has been placed in the OFF position Does the user's wireless keyboard exhibit this symptom?	No	Go to step 17.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
17.	Verify if the user's wireless keyboard has any other power-related issue that is not related to the power button or switch.	Yes	Replace the user's wireless keyboard. Verify that the issue is resolved.	K20	KEYBOARD
	Confirm that the issue with the user's wireless keyboard is: <ul style="list-style-type: none"> Power Issue, not due to power button or switch Does the user's wireless keyboard exhibit this symptom?	No	Go to step 18.	\$(nodeText.noSymptomCode)	
18.	If the user's issue involves pairing or connecting to a Magic Keyboard, then you can connect to, pair, and use this device with the computer using either Bluetooth or a Lightning cable.	Yes	Go to step 19.	\$(nodeText.yesSymptomCode)	
	If Bluetooth pairing is not possible due to interference or other reasons, then try connecting the user's Magic Keyboard to the known-good computer with a known-good Lightning cable. For other Apple Bluetooth peripherals, select the "Yes" answer to continue. Does the user's Magic Keyboard connect and pair using USB?	No	Replace the user's wireless keyboard. Verify that the issue is resolved.	K30	KEYBOARD
19.	Verify that a known-good computer can recognize the user's wireless keyboard.	Yes	Replace the user's wireless keyboard. Verify that the issue is resolved.	K15	KEYBOARD
	Confirm that the issue with the user's wireless keyboard is: <ul style="list-style-type: none"> User's wireless keyboard is not recognized by known-good computer Does the user's wireless keyboard exhibit this symptom?	No	Go to step 20.	\$(nodeText.noSymptomCode)	
20.	Verify that a known-good computer can pair with the user's wireless keyboard using Bluetooth.	Yes	Replace the user's wireless keyboard. Verify that the issue is resolved.	K07	KEYBOARD
	Confirm that the issue with the user's wireless keyboard is: <ul style="list-style-type: none"> User's wireless keyboard cannot pair with a known-good computer Does the user's wireless keyboard exhibit this symptom?	No	Go to step 21.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
21.	Verify that a known-good computer maintains a Bluetooth connection to the user's wireless keyboard, and does not drop this connection.	Yes	Replace the user's wireless keyboard. Verify that the issue is resolved.	K08	KEYBOARD
	Confirm that the issue with the user's wireless keyboard is: <ul style="list-style-type: none"> User's wireless keyboard intermittently loses its connection with a known-good computer Does the user's wireless keyboard exhibit this symptom?	No	Go to step 22.	\$(nodeText.noSymptomCode)	
22.	Ask the user how often and how long the wireless keyboard is used.	Yes	Go to step 23.	\$(nodeText.yesSymptomCode)	
	Explain to the user that the battery issue could likely be caused by the user using the wireless keyboard continuously over a long period of time, rather than any fault of the wireless keyboard itself, macOS, or the user's computer. Gain agreement from the user that lengthy wireless keyboard usage is likely to be the cause of the battery life issue, and that there is no service issue with the wireless keyboard itself. Does the user agree that the battery life issue is likely caused by lengthy wireless keyboard usage?	No	Replace the user's wireless keyboard. Verify that the issue is resolved.	K32	KEYBOARD
23.	Attempt to charge the user's wireless keyboard battery for several more minutes. Verify that the user's wireless keyboard battery charge level that appears on the known-good computer that is paired with this user's wireless keyboard has increased and shows that the user's wireless keyboard is charging.	Yes	Replace the user's wireless keyboard. Verify that the issue is resolved.	K31	KEYBOARD
	Confirm that the issue with the user's wireless keyboard is: <ul style="list-style-type: none"> User's wireless keyboard battery will not charge Note: This symptom does not apply to peripherals with replaceable batteries. Does the user's wireless keyboard exhibit this symptom?	No	Go to step 24.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
24.	Closely inspect the user's wireless keyboard enclosure for signs of a swollen battery.	Yes	Replace the user's wireless keyboard.	K33	KEYBOARD
	Confirm that the issue with the user's wireless keyboard is: <ul style="list-style-type: none"> User's wireless keyboard battery appears swollen <p>Note: This symptom does not apply to peripherals with replaceable batteries.</p> <p>Does the user's wireless keyboard exhibit this symptom?</p>		Verify that the issue is resolved.		
		No	Go to step 25.	\$(nodeText.noSymptomCode)	
25.	Verify that each and every wireless keyboard key functions as expected when pressed and released.	Yes	Replace the user's wireless keyboard.	K01	KEYBOARD
	Confirm that the issue with the user's wireless keyboard is: <ul style="list-style-type: none"> Specific key(s) do not work <p>Does the user's wireless keyboard exhibit this symptom?</p>		Verify that the issue is resolved.		
		No	Go to step 26.	\$(nodeText.noSymptomCode)	
26.	Verify that each and every wireless keyboard key functions as expected when pressed and released.	Yes	Replace the user's wireless keyboard.	K05	KEYBOARD
	Confirm that the issue with the user's wireless keyboard is: <ul style="list-style-type: none"> Keys seem to stick, do not respond properly, or respond slowly <p>Does the user's wireless keyboard exhibit this symptom?</p>		Verify that the issue is resolved.		
		No	Go to step 27.	\$(nodeText.noSymptomCode)	
27.	Verify that each and every wireless keyboard key is intact and not missing.	Yes	Replace the user's wireless keyboard.	K27	KEYBOARD
	Confirm that the issue with the user's wireless keyboard is: <ul style="list-style-type: none"> Keys missing or falling off keyboard <p>Does the user's wireless keyboard exhibit this symptom?</p>		Verify that the issue is resolved.		
		No	Go to step 28.	\$(nodeText.noSymptomCode)	
28.	Verify that the wireless keyboard language is as expected.	Yes	Replace the user's wireless keyboard.	K04	KEYBOARD
	Confirm that the issue with the user's wireless keyboard is: <ul style="list-style-type: none"> Wrong keyboard language version <p>Does the user's wireless keyboard exhibit this symptom?</p>		Verify that the issue is resolved.		
		No	Issue cannot be duplicated.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
29.	Look for for any signs of power on the user's wireless mouse or trackpad, such as a power LED turning on. Note: Not all devices have a power LED.	Yes	Go to step 30.	\${nodeText.yesSymptomCode}	
	Verify that the user's wireless mouse or trackpad turns ON when the power button or switch is placed in the ON position.	No	Go to step 34.	\${nodeText.noSymptomCode}	
	Verify that the user's wireless mouse or trackpad turns OFF when the power button or switch is placed in the OFF position.				
	Does the user's wireless mouse or trackpad exhibit any power-related symptoms?				
30.	Confirm that the issue with the user's wireless mouse or trackpad is:	Yes	Replace the user's wireless mouse or trackpad.	K09	MOUSE
	<ul style="list-style-type: none"> User's wireless mouse or trackpad is not functioning at all (seems dead, no power, power LED does not turn on) 		Verify that the issue is resolved.		
	Does the user's wireless mouse or trackpad exhibit this symptom?	No	Go to step 31.	\${nodeText.noSymptomCode}	
31.	Verify that the user's wireless mouse or trackpad turns ON when the power button or switch is placed in the ON position.	Yes	Replace the user's wireless mouse or trackpad.	K19	MOUSE
	Confirm that the issue with the user's wireless mouse or trackpad is:		Verify that the issue is resolved.		
	<ul style="list-style-type: none"> Power switch or button is defective 	No	Go to step 32.	\${nodeText.noSymptomCode}	
	Does the user's wireless mouse or trackpad exhibit this symptom?				
32.	Verify that the user's wireless mouse or trackpad turns off when the power button or switch is placed in the OFF position.	Yes	Replace the user's wireless mouse or trackpad.	K34	MOUSE
	Confirm that the issue with the user's wireless mouse or trackpad is:		Verify that the issue is resolved.		
	<ul style="list-style-type: none"> User's wireless mouse or trackpad remains ON when power button or switch has been placed in the OFF position 	No	Go to step 33.	\${nodeText.noSymptomCode}	
	Does the user's wireless mouse or trackpad exhibit this symptom?				

	Check	Result	Action	Code	Commodity
33.	Verify if the user's wireless mouse or trackpad has any other power-related issue that is not related to the power button or switch.	Yes	Replace the user's wireless mouse or trackpad. Verify that the issue is resolved.	K20	MOUSE
	Confirm that the issue with the user's wireless mouse or trackpad is: <ul style="list-style-type: none"> Power Issue, not due to power button or switch Does the user's wireless mouse or trackpad exhibit this symptom?	No	Go to step 34.	\$(nodeText.noSymptomCode)	
34.	If the user's issue involves pairing or connecting to a Magic Mouse 2 or Magic Trackpad 2, then you can connect to and pair these devices with a computer using either Bluetooth or a Lightning cable.	Yes	Go to step 35.	\$(nodeText.yesSymptomCode)	
	If Bluetooth pairing is not possible due to interference or other reasons, then try connecting the user's Magic Mouse 2 or Magic Trackpad 2 to a known-good computer with a known-good Lightning cable. For other Apple Bluetooth peripherals, select the "Yes" answer to continue. Does the user's Magic Mouse 2 or Magic Trackpad 2 connect and pair using USB?	No	Replace the user's wireless mouse or trackpad. Verify that the issue is resolved.	K30	MOUSE
35.	Verify that a known-good computer can recognize the user's wireless mouse or trackpad.	Yes	Replace the user's wireless mouse or trackpad. Verify that the issue is resolved.	K15	MOUSE
	Confirm that the issue with the user's wireless mouse or trackpad is: <ul style="list-style-type: none"> User's wireless mouse or trackpad is not recognized by known-good computer. Does the user's wireless mouse or trackpad exhibit this symptom?	No	Go to step 36.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
36.	Verify that a known-good computer can pair with the user's wireless mouse or trackpad.	Yes	Replace the user's wireless mouse or trackpad. Verify that the issue is resolved.	K07	MOUSE
	Confirm that the issue with the user's wireless mouse or trackpad is: <ul style="list-style-type: none"> User's wireless mouse or trackpad cannot pair with a known-good computer Does the user's wireless mouse or trackpad exhibit this symptom?	No	Go to step 37.	\$(nodeText.noSymptomCode)	
37.	Verify that a known-good computer maintains a Bluetooth connection to the user's wireless mouse or trackpad, and does not drop this connection.	Yes	Replace the user's wireless mouse or trackpad. Verify that the issue is resolved.	K08	MOUSE
	Confirm that the issue with the user's wireless mouse or trackpad is: <ul style="list-style-type: none"> User's wireless mouse or trackpad intermittently loses its connection with a known-good computer Does the user's wireless mouse or trackpad exhibit this symptom?	No	Go to step 38.	\$(nodeText.noSymptomCode)	
38.	Ask the user how often and how long the wireless mouse or trackpad is used.	Yes	Go to step 39.	\$(nodeText.yesSymptomCode)	
	Gain agreement from the user that lengthy wireless mouse or trackpad usage is likely to be the cause of the battery life issue, and that there is no service issue with the wireless mouse or trackpad itself. Does the user agree that the battery life issue is likely caused by lengthy wireless device usage?	No	Replace the user's wireless mouse or trackpad. Verify that the issue is resolved.	K32	MOUSE

	Check	Result	Action	Code	Commodity
39.	Attempt to charge the user's wireless mouse or trackpad battery for several more minutes. Verify that the user's wireless mouse or trackpad battery charge level that appears on the known-good computer that is paired with this user's wireless mouse or trackpad has increased and shows that the user's wireless mouse or trackpad is charging.	Yes	Replace the user's wireless mouse or trackpad. Verify that the issue is resolved.	K31	MOUSE
	Confirm that the issue with the user's wireless mouse or trackpad is: <ul style="list-style-type: none"> User's wireless mouse or trackpad battery will not charge <p>Note: This symptom does not apply to peripherals with replaceable batteries.</p> <p>Does the user's wireless mouse or trackpad exhibit this symptom?</p>	No	Go to step 40.	\$(nodeText.noSymptomCode)	
40.	Closely inspect the user's wireless mouse or trackpad enclosure for signs of a swollen battery.	Yes	Replace the user's wireless mouse or trackpad. Verify that the issue is resolved.	K33	MOUSE
	Confirm that the issue with the user's wireless mouse or trackpad is: <ul style="list-style-type: none"> User's wireless mouse or trackpad battery appears swollen <p>Note: This symptom does not apply to peripherals with replaceable batteries.</p> <p>Does the user's wireless mouse or trackpad exhibit this symptom?</p>	No	Go to step 41.	\$(nodeText.noSymptomCode)	
41.	Isolate failure to either user's wireless mouse or wireless trackpad.	Wireless mouse	Go to step 42.	\$(nodeText.yesSymptomCode)	
	Which peripheral is malfunctioning?	Wireless trackpad	Go to step 45.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
42.	Verify that the overall function of the user's wireless mouse performs as expected when used with the known-good computer.	Yes	Replace the user's wireless mouse. Verify that the issue is resolved.	K26	MOUSE
	Confirm that the issue with the user's wireless mouse is: <ul style="list-style-type: none"> No mouse response Does the user's wireless mouse exhibit this symptom?	No	Go to step 43.	\$(nodeText.noSymptomCode)	
43.	Verify that the clicking function of the user's wireless mouse performs as expected when pressed and released.	Yes	Replace the user's wireless mouse. Verify that the issue is resolved.	K14	MOUSE
	Confirm that the issue with the user's wireless mouse is: <ul style="list-style-type: none"> Mouse clicking function not working properly Does the user's wireless mouse exhibit this symptom?	No	Go to step 44.	\$(nodeText.noSymptomCode)	
44.	Verify that the touch gesture function of the user's wireless mouse performs as expected when the mouse surface is touched.	Yes	Replace the user's wireless mouse. Verify that the issue is resolved.	K18	MOUSE
	Confirm that the issue with the user's wireless mouse is: <ul style="list-style-type: none"> Touch/Multi-Touch gesture issue Does the user's wireless mouse exhibit this symptom?	No	Issue cannot be duplicated.	\$(nodeText.noSymptomCode)	
45.	Verify that the overall function of the user's wireless trackpad performs as expected when used with the known-good computer.	Yes	Replace the user's wireless trackpad. Verify that the issue is resolved.	K23	MOUSE
	Confirm that the issue with the user's wireless trackpad is: <ul style="list-style-type: none"> Trackpad cursor not responding Does the user's wireless trackpad exhibit this symptom?	No	Go to step 46.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
46.	Verify that the user's wireless trackpad exhibits smooth continuous tracking when used with the known-good computer, and does not skip or behave erratically.	Yes	Replace the user's wireless trackpad. Verify that the issue is resolved.	K12	MOUSE
	Confirm that the issue with the user's wireless trackpad is: <ul style="list-style-type: none"> Trackpad cursor not tracking properly Does the user's wireless trackpad exhibit this symptom?	No	Go to step 47.	\$(nodeText.noSymptomCode)	
47.	Verify that the clicking function of the user's wireless trackpad performs as expected when pressed and released, and that the click is recognized by the known-good computer.	Yes	Replace the user's wireless trackpad. Verify that the issue is resolved.	K13	MOUSE
	Confirm that the issue with the user's wireless trackpad is: <ul style="list-style-type: none"> Trackpad click not recognized Does the user's wireless trackpad exhibit this symptom?	No	Go to step 48.	\$(nodeText.noSymptomCode)	
48.	Verify that the user's wireless trackpad clicking function does not require excessive force when pressed and released.	Yes	Replace the user's wireless trackpad. Verify that the issue is resolved.	K24	MOUSE
	Confirm that the issue with the user's wireless trackpad is: <ul style="list-style-type: none"> Trackpad requires high click force Does the user's wireless trackpad exhibit this symptom?	No	Go to step 49.	\$(nodeText.noSymptomCode)	
49.	Verify that the user's wireless trackpad clicking function is not overly sensitive to clicking when pressed and released.	Yes	Replace the user's wireless trackpad. Verify that the issue is resolved.	K25	MOUSE
	Confirm that the issue with the user's wireless trackpad is: <ul style="list-style-type: none"> Trackpad click oversensitive Does the user's wireless trackpad exhibit this symptom?	No	Go to step 50.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
50.	Verify that the user's wireless trackpad Force Touch function performs as expected and that haptic feedback is felt in response. Note: This feature does not apply to all models.	Yes	Replace the user's wireless trackpad. Verify that the issue is resolved.	K29	MOUSE
	Confirm that the issue with the user's wireless trackpad is: <ul style="list-style-type: none"> Trackpad Force Touch or haptic feedback issue 	No	Issue cannot be duplicated.	<code> \${nodeText.noSymptomCode} </code>	
	Does the user's wireless trackpad exhibit this symptom?				

External Apple Wired Keyboard and Mouse

Unlikely causes:

There are no unlikely causes for this issue.

Quick Check

Symptoms	Quick Check
<p>Apple wired USB keyboard or mouse does not function with user's computer, or shows one or more of the following symptoms:</p> <ul style="list-style-type: none">• Mouse button(s) does not click• Mouse scroll ball does not operate smoothly• No mouse response• Keyboard keys stick• Keyboard keys loose or missing• One or more keys do not respond when pressed• No keyboard response at all• Apple wired mouse causes erratic cursor tracking• Apple wired keyboard or mouse is not recognized• Apple wired keyboard or mouse has physical damage that affects operation• Paint is wearing off of one or more keys on the keyboard• Apple wired keyboard or mouse has cosmetic damage that does not affect operation <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none">1. Disconnect all USB devices from the user's computer except for the user's mouse or keyboard. Troubleshoot only one device at a time to help isolate the issue.2. Unplug the keyboard or mouse from the USB port, wait a few seconds, and reconnect it.3. Connect the keyboard or mouse to another USB port on the user's computer.4. Make sure the USB connectors are plugged in completely and correctly.5. Visually inspect the USB connectors and ports for damage or debris.6. Try operating the user's mouse on another surface. Ask the user about the type of surface usually being used with the mouse. Glossy or transparent surfaces, or those with repetitive patterns, may cause mouse-tracking errors or faulty mouse operation. Explain that solid, non-reflective, opaque surfaces work best. The surface should be clean, but not shiny.7. Visually inspect the user's keyboard or mouse for dirt, hair, liquid damage, or other debris. Check to see if the user has pets. Pet hair can lay across the laser and cause intermittent mouse issues. Refer to article HT204172: How to clean your Apple products for information on cleaning the user's keyboard or mouse.8. Connect the user's USB keyboard or mouse to an available USB port on a known-good computer to determine if the issue is related to the USB port on the user's computer, or to the user's USB keyboard or mouse. If the user's keyboard or mouse functions when used with a known-good computer, go to the “USB Port Not Recognized” troubleshooting flow.9. For keyboard issues, refer to HT204540: If your Apple keyboard doesn't work for troubleshooting tips.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	<p>Visually inspect the user's USB mouse or keyboard to verify that the attached USB cable and/or connector is not damaged or frayed.</p> <p>Check the user's keyboard or mouse for physical and/or liquid damage.</p> <p>On mice, verify that all mouse buttons click and the laser tracking LED illuminates.</p> <p>On keyboards, verify that all keyboard buttons are present and can be depressed normally.</p> <p>Does the user's USB mouse or keyboard, or its attached cable or connector, show signs of damage?</p>	Yes	Go to step 2.	\${nodeText.yesSymptomCode}	
		No	Go to step 12.	\${nodeText.noSymptomCode}	
2.	<p>Isolate the damage issue to either the user's wired USB keyboard or mouse.</p> <p>Which peripheral is damaged?</p>	USB Keyboard	Go to step 3.	\${nodeText.yesSymptomCode}	
		USB Mouse	Go to step 9.	\${nodeText.noSymptomCode}	
3.	<p>Closely examine the user's keyboard to determine the exact nature of its issue.</p> <p>Look for any signs of liquid spill, liquid penetration, or liquid damage to the keyboard.</p> <p>Is damage to the user's keyboard related to liquid spill?</p>	Yes	<p>Replace USB keyboard. Verify issue resolved.</p> <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	K90	KEYBOARD
		No	Go to step 4.	\${nodeText.noSymptomCode}	
4.	<p>Click each key to ensure all keys are not sticking in the down or up position.</p> <p>Is damage to the user's keyboard related to sticky keys or slow key response?</p>	Yes	<p>Replace USB keyboard. Verify issue resolved.</p> <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	K05	KEYBOARD
		No	Go to step 5.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
5.	Look for any loose or missing keycaps. Is damage to the user's keyboard related to loose or missing keycaps?	Yes	Replace USB keyboard. Verify issue resolved. Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.	K27	KEYBOARD
		No	Go to step 6.	\${nodeText.noSymptomCode}	
6.	Closely inspect the keyboard for any signs of physical damage that may affect operation. Does the user's keyboard exhibit this symptom?	Yes	Replace USB keyboard. Verify issue resolved. Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.	K16	KEYBOARD
		No	Go to Step 7.	\${nodeText.noSymptomCode}	
7.	Closely examine the keyboard for signs of paint wearing off of one or more keys. Does the user's keyboard exhibit this symptom?	Yes	Replace USB keyboard. Verify issue resolved. Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.	K35	KEYBOARD
		No	Go to step 8.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
8.	<p>Closely inspect the keyboard for any signs of cosmetic damage that does not affect operation.</p> <p>Does the user's keyboard exhibit this symptom?</p>	Yes	<p>Replace USB keyboard. Verify issue resolved.</p> <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	K21	KEYBOARD
		No	Issue cannot be duplicated.	<p> <code> \${nodeText.noSymptomCode} </code> </p>	
9.	<p>Closely examine user's mouse to determine exact nature of the issue.</p> <p>Look for any signs of liquid spill, liquid penetration, or liquid damage to mouse.</p> <p>Is damage to user's mouse related to liquid spill?</p>	Yes	<p>Replace USB mouse. Verify issue resolved.</p> <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	K90	MOUSE
		No	Go to step 10.	<p> <code> \${nodeText.noSymptomCode} </code> </p>	
10.	<p>Closely inspect the mouse for any signs of physical damage that may affect operation.</p> <p>Is there physical damage to user's mouse?</p>	Yes	<p>Replace USB mouse. Verify issue resolved.</p> <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	K16	MOUSE
		No	Go to step 11.	<p> <code> \${nodeText.noSymptomCode} </code> </p>	

	Check	Result	Action	Code	Commodity
11.	Closely inspect the mouse for any signs of cosmetic damage that does not affect operation.	Yes	Replace USB mouse. Verify issue resolved. Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.	K21	MOUSE
	Is there cosmetic damage to user's mouse?	No	Issue cannot be duplicated.	\${nodeText.noSymptomCode}	
12.	Isolate failure issue to either user's wired USB keyboard or mouse.	USB Keyboard	Go to step 17.	\${nodeText.yesSymptomCode}	
	Which peripheral is malfunctioning?	USB Mouse	Go to step 13.	\${nodeText.noSymptomCode}	
13.	Connect user's USB mouse to a free USB port on a known-good computer, and check System Information to determine whether the computer recognizes the mouse.	Yes	Go to step 14.	\${nodeText.yesSymptomCode}	
	Is mouse recognized by a known-good computer?	No	Replace USB mouse. Verify issue resolved.	K15	MOUSE
14.	Move the mouse and verify that the cursor on the known-good computer screen moves smoothly.	Yes	Replace USB mouse. Verify issue resolved.	K26	MOUSE
	Is issue related to mouse function?	No	Go to step 15.	\${nodeText.noSymptomCode}	
15.	Click and roll the mouse's scroll ball to check that it rolls freely in all directions, with no physical resistance.	Yes	Replace USB mouse. Verify issue resolved.	K06	MOUSE
	Is issue related to the scroll ball?	No	Go to step 16.	\${nodeText.noSymptomCode}	
16.	Click the mouse's various buttons to verify they click properly, without sticking, each time they are pressed.	Yes	Replace USB mouse. Verify issue resolved.	K14	MOUSE
	Is issue related to the mouse button(s)?	No	Issue cannot be duplicated.	\${nodeText.noSymptomCode}	
17.	Connect user's USB keyboard to a free USB port on a known-good computer, and check System Information to determine whether the computer recognizes the keyboard.	Yes	Go to step 18.	\${nodeText.yesSymptomCode}	
	Is keyboard recognized by a known-good computer?	No	Replace USB keyboard. Verify issue resolved.	K15	KEYBOARD

	Check	Result	Action	Code	Commodity
18.	Verify that each and every keyboard key functions as expected when pressed and released.	Yes	Replace USB keyboard. Verify issue resolved.	K01	KEYBOARD
	Is issue related to specific keys not working?	No	Go to step 19.	\${nodeText.noSymptomCode}	
19.	Verify that the keyboard language is as expected.	Yes	Replace USB keyboard. Verify issue resolved.	K04	KEYBOARD
	Is issue related to keyboard language?	No	Issue cannot be duplicated.	\${nodeText.noSymptomCode}	

Internal Microphone Issues

Unlikely causes:

Wireless card, battery, bottom case, fan, flash storage, heat sink, power adapter, speakers, top case, trackpad

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• Microphone not working, but audio output is functional• Microphone audio is garbled• Internal microphone input cannot be selected. <p>Note: Inform the user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: Determining and quoting accidental damage for Mac portables.</p>	<ol style="list-style-type: none">1. Go to System Preferences > Sound, and verify the following: Input tab:<ul style="list-style-type: none">• Internal microphone source is available and selected.• Input volume slider is not set to zero.Output tab:<ul style="list-style-type: none">• Sound output device is set to internal speakers.• Output volume is not muted or set to zero.2. Go to System Preferences > Sound > Input tab, and verify that the input level indicator moves when speaking into the microphone.3. Check that no cables are inserted into the audio input jack. Use an otoscope to visually inspect audio jack. Use compressed air to clean and remove any debris.4. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.5. Refer to HT204319: macOS versions and builds included with Mac computers to check that the system build is correct for this computer model.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Start up computer using an up-to-date, bootable macOS volume. See articles HT201314: About macOS Recovery and HT204319: macOS versions and builds included with Mac computers . Does the audio issue persist from a known-good OS?	Yes	Go to step 2.	`\${nodeText.yesSymptomCode}`	
		No	Reinstall macOS on the user's computer. Refer to HT204319: macOS versions and builds included with Mac computers to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.	`\${nodeText.noSymptomCode}`	
2.	Disconnect any connected headphones or external speakers. Check whether System Preferences > Sound > Input tab shows an "Internal microphone" source available and selected. Does System Preferences list "External microphone" instead?	Yes	Go to step 3.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 4.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
3.	Run Apple Service Toolkit (AST 2) Audio Test to verify that built-in microphone detects expected audio test patterns produced from each speaker.	Yes	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	
	Refer to article TP587: Using Audio Test . Does unit pass AST 2 Audio Test?	No	Go to step 4.	\${nodeText.noSymptomCode}	
4.	The microphone is located along the inner side of the top case and connected to the I/O board.	Yes	Go to step 5.	\${nodeText.yesSymptomCode}	
	Inspect the cable and connector on the I/O board for any damage. Is there any damage to the microphone cable or connectors?	No	Go to step 6.	\${nodeText.noSymptomCode}	
5.	Determine whether the damage is located on the microphone cable, the I/O board, or a combination of multiple components. Is the damage limited to the microphone cable only?	Yes	Microphone is part of top case. Replace the top case assembly with keyboard and trackpad. Run AST 2 Trackpad Calibration Check to verify the proper functionality of the trackpad, as well as recalibrate it if necessary. Refer to TP1314: Trackpad Calibration Check for instructions. Verify that the issue is resolved.	K36	KEYBOARD
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	

	Check	Result	Action	Code	Commodity
6.	Reseat the microphone cable connector to the audio board. Retest by going to System Preferences > Sound > Input tab, and verifying that the input level indicator moves when speaking into the microphone. Is the microphone recognized and functional?	Yes	Go to step 7.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 8.	`\${nodeText.noSymptomCode}`	
7.	Run Apple Service Toolkit (AST 2) Audio Test to verify that built-in microphone detects expected audio test patterns produced from each speaker. Refer to article TP587: Using Audio Test . Does unit pass AST 2 Audio Test?	Yes	Issue resolved by reseating the microphone cable. Verify that the issue is resolved.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 8.	`\${nodeText.noSymptomCode}`	
8.	Remove the bottom case and disconnect battery. Disconnect the input/output (I/O) flex cable from the logic board and the I/O board. Inspect the cable and connectors for damage. Look for pinching or crimping, and damaged or bent pins. Does the I/O flex cable show signs of damage?	Yes	Go to step 9.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 10.	`\${nodeText.noSymptomCode}`	
9.	Inspect the logic board and I/O board I/O connectors for damage. Is the connector on the logic board or I/O board also damaged?	Yes	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	
		No	Replace the I/O flex cable. Verify that the issue is resolved.	X03	INTERNAL CABLE
10.	While the I/O flex cable is removed, disconnect the I/O power cable from the logic board. Inspect the cable and connector for damage. Look for pinching or crimping, and damaged or bent pins. Does the I/O power cable show signs of damage?	Yes	Replace the I/O board. Verify that the issue is resolved.	M24	OTHER BOARD
		No	Go to step 11.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
11.	<p>Inspect the logic board I/O flex cable and power cable connectors for damage.</p> <p>Does either connector on the logic board show signs of damage?</p>	Yes	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M24	MLB
		No	Go to step 12.	\$(nodeText.noSymptomCode)	
12.	<p>Inspect the I/O board I/O flex cable connector for damage.</p> <p>Does the connector on the I/O board show signs of damage?</p>	Yes	<p>Replace the I/O board.</p> <p>Verify that the issue is resolved.</p>	M24	OTHER BOARD
		No	Go to step 13.	\$(nodeText.noSymptomCode)	
13.	<p>Reseat the I/O board flex cable and power cable connections to the logic board and I/O board.</p> <p>Retest by going to System Preferences > Sound > Input tab, and verifying that the input level indicator moves when speaking into the microphone.</p> <p>Is the microphone recognized and functional?</p>	Yes	Go to step 14.	\$(nodeText.yesSymptomCode)	
		No	<p>Microphone is part of top case.</p> <p>Replace the top case.</p> <p>Run AST 2 Trackpad Calibration Check to verify the proper functionality of the trackpad, as well as recalibrate it if necessary.</p> <p>Refer to TP1314: Trackpad Calibration Check for instructions.</p> <p>Verify that the issue is resolved.</p>	K36	KEYBOARD

	Check	Result	Action	Code	Commodity
14.	<p>Run Apple Service Toolkit (AST 2) Audio Test to verify that built-in microphone detects expected audio test patterns produced from each speaker.</p> <p>Refer to article TP587: Using Audio Test.</p> <p>Does unit pass AST 2 Audio Test?</p>	Yes	<p>Issue resolved by reseating the I/O flex cable or power cable.</p> <p>Verify that the issue is resolved.</p>	<p>\$(nodeText.yesSymptomCode)</p>	
		No	<p>Microphone is part of top case.</p> <p>Replace the top case.</p> <p>Run AST 2 Trackpad Calibration Check to verify the proper functionality of the trackpad, as well as recalibrate it if necessary.</p> <p>Refer to TP1314: Trackpad Calibration Check for instructions.</p> <p>Verify that the issue is resolved.</p>	<p>K36</p>	KEYBOARD
15.	<p>Verify that the “Internal microphone” device is available, selected, and functional, and that the input level indicator moves when speaking into the microphone. Then record a sample audio file and play it back to verify that it is free of distortion.</p> <p>Run AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Is the issue resolved?</p>	Yes	<p>Issue resolved.</p>	<p>\$(nodeText.yesSymptomCode)</p>	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	<p>M99</p>	

No Audio from Internal Speaker(s) or Headphone Jack

Unlikely causes:

Wireless card, battery, bottom case, display clamshell, fan, flash storage, heat sink, power adapter, top case, trackpad

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">No sound from headphones jackNo sound from left and right speakers <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables.</p>	<ol style="list-style-type: none">Test with a known-good sound file.Connect headphones or external speakers to the external audio port. Verify In System Preferences > Sound > Output whether the Audio Out setting switches to "Headphones," and if audio can be played on external speakers.Disconnect any device connected to the external audio port. In System Preferences > Sound > Output, check that sound output device reverts to "Internal Speakers" and that the Balance slider is set halfway between "left" and "right."In System Preferences > Sound > Output, adjust the Output volume and use the balance slider to isolate the left and right speakers.Test the audio output using more than one application or website.Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates.

Deep Dive

	Check	Result	Action	Code	Commodity
1.		Yes	Go to step 2.	\$(nodeText.yesSymptomCode)	
	Start up computer using an up-to-date, bootable macOS volume. See articles HT201314: About macOS Recovery and HT204319: macOS versions and builds included with Mac computers .	No	Reinstall macOS on the user's computer. Refer to HT204319: macOS versions and builds included with Mac computers to	\$(nodeText.noSymptomCode)	
	Retest for speaker or headphone jack audio issue. Does the audio issue persist in a known-good OS?		check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.		

	Check	Result	Action	Code	Commodity
2.	<p>Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.</p> <p>In System Preferences > Sound > Output, adjust Output volume and retest. Play audio through internal speakers and known-good headphones or external speakers.</p> <p>Can you hear audio through internal speakers and headphones/external speakers?</p>	Yes	Issue resolved. Verify resolution.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 3.	`\${nodeText.noSymptomCode}`	
3.	<p>Play a known-good audio file on internal speakers, then connect known-good headphones or external speakers and compare for distortion.</p> <p>Is the issue isolated to the internal speakers?</p>	Yes	Go to step 13.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 4.	`\${nodeText.noSymptomCode}`	
4.	<p>Remove the bottom case and disconnect battery. Disconnect the input/output (I/O) flex cable from the logic board and the I/O board.</p> <p>Inspect the cable and connectors for damage. Look for pinching or crimping, and damaged or bent pins.</p> <p>Does the I/O flex cable show signs of damage?</p>	Yes	Go to step 5.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 6.	`\${nodeText.noSymptomCode}`	
5.	<p>Inspect the logic board and I/O board I/O connectors for damage.</p> <p>Is the connector on the logic board or I/O board also damaged?</p>	Yes	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	
		No	Replace the I/O flex cable. Verify that the issue is resolved.	X03	INTERNAL CABLE
6.	<p>While the I/O flex cable is removed, disconnect the I/O power cable from the logic board.</p> <p>Inspect the cable and connector for damage. Look for pinching or crimping, and damaged or bent pins.</p> <p>Does the I/O power cable show signs of damage?</p>	Yes	Replace the I/O board. Verify that the issue is resolved.	M24	OTHER BOARD
		No	Go to step 7.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
7.	Inspect the logic board I/O flex cable and power cable connectors for damage. Does either connector on the logic board show signs of damage?	Yes	Replace the logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	M24	MLB
		No	Go to step 8.	\$(nodeText.noSymptomCode)	
8.	Inspect the I/O board I/O flex cable connector for damage. Does the connector on the I/O board show signs of damage?	Yes	Replace the I/O board. Verify that the issue is resolved.	M24	OTHER BOARD
		No	Go to step 9.	\$(nodeText.noSymptomCode)	
9.	Reseat the I/O board flex cable and power cable connections to the logic board and I/O board. Retest for audio issue. Is internal/external sound now audible, clear, and free of distortion?	Yes	Issue resolved by reseating the I/O flex cable or power cable. Verify that the issue is resolved.	\$(nodeText.yesSymptomCode)	
		No	Go to step 10.	\$(nodeText.noSymptomCode)	
10.	To completely troubleshoot this issue, the following known-good parts are required. <ul style="list-style-type: none"> I/O flex cable I/O board Do you have immediate access to each of these known-good parts?	Yes	Go to step 11.	\$(nodeText.yesSymptomCode)	
		No	Replace the I/O flex cable. Verify that the issue is resolved.	X03	INTERNAL CABLE
11.	Substitute a known-good I/O flex cable. Retest for audio issue. Is internal/external sound now audible, clear, and free of distortion?	Yes	Replace the I/O flex cable. Verify that the issue is resolved.	X08	INTERNAL CABLE
		No	Go to step 12.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
12.	Substitute a known-good I/O board. Retest for audio issue. Is internal/external sound now audible, clear, and free of distortion?	Yes	Replace the I/O board. Reinstall user's I/O flex cable. Verify that the issue is resolved.	M09	OTHER BOARD
		No	Replace the logic board. Reinstall user's I/O flex cable and I/O board. Use Blank Board Serializer (BBS) to set the computer's serial number. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	M09	MLB
13.	Disconnect headphones/external speakers. Run AST 2 Audio Test to verify left and right speakers produce expected audio test patterns from each speaker. Refer to article TP587: Using Audio Test .	Yes	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	
		No	Go to step 14.	\$(nodeText.noSymptomCode)	
14.	Remove the bottom case and disconnect battery. Inspect the cables that connect the left and right speakers to the logic board and I/O board. Check for damage to either cable, its connectors, and the logic board and I/O board connectors. Did you find damage to either cable, or logic board or I/O board connectors?	Yes	Go to step 15.	\$(nodeText.yesSymptomCode)	
		No	Go to step 16.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
15.	The speaker flex cables are part of each speaker, and both speakers must be replaced as a matched pair.	Yes	Speakers are replaced as a matched set. Replace speakers with a matched-pair replacement kit. Verify that the issue is resolved.	X03	OTHER ELECTRIC
	Determine whether damage is on the logic board, I/O board, or either speaker. Is the damage limited to speaker?	No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	
16.	Reconnect the speaker cables to the logic board and I/O board, ensuring a good connection. Run AST 2 Audio Test to verify left and right speakers produce expected audio test patterns from each speaker. Refer to article TP587: Using Audio Test .	Yes	The issue was resolved by reseating the speaker flex cables. Verify that the issue is resolved.	`\${nodeText.yesSymptomCode}`	
	Does unit pass AST 2 Audio Test?	No	Go to step 17.	`\${nodeText.noSymptomCode}`	
17.	To fully troubleshoot this issue, a known-good left and right speaker pair is required. Do you have immediate access to known-good left and right speakers?	Yes	Go to step 18.	`\${nodeText.yesSymptomCode}`	
		No	Speakers are replaced as a matched set. Replace speakers with a matched-pair replacement kit. Verify that the issue is resolved.	X08	OTHER ELECTRIC
18.	Substitute a known-good left and right speaker pair and retest the audio. Is the issue resolved by known-good left and right speakers?	Yes	Speakers are replaced as a matched set. Replace speakers with a matched-pair replacement kit. Verify that the issue is resolved.	X08	OTHER ELECTRIC
		No	Go to step 19.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
19.	<p>The left speaker is connected to the I/O board. The right speaker is connected to the logic board.</p> <p>Isolate which speaker has distorted sound. If both speakers have distorted sound, select 'logic board'.</p> <p>Which speaker has no sound?</p>	Left	<p>Replace the I/O board.</p> <p>Verify that the issue is resolved.</p>	M09	OTHER BOARD
		Right or Both	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run AST 2 Trackpad Calibration Check to verify the proper functionality of the trackpad, as well as recalibrate it if necessary.</p> <p>Refer to TP1314: Trackpad Calibration Check for instructions.</p> <p>Verify the issue is resolved.</p>	M09	MLB
20.	<p>Connect and disconnect headphones/external speakers. Verify that audio can be played through both external and internal speakers, and that sound is clear and free of distortion.</p> <p>Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Is the issue resolved?</p>	Yes	The issue is resolved. Verify resolution.	\$(nodeText.yesSymptomCode)	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	

No Audio To External Display Speakers

Unlikely causes:

Wireless card, battery, bottom case, display clamshell, fan, flash storage, heat sink, power adapter, top case, trackpad

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">Sound cannot be enabled on the speakers of an external Thunderbolt, Mini DisplayPort or HDMI display. <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables.</p>	<ol style="list-style-type: none">Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates.In System Preferences > Sound > Output, select “Internal Speakers” then play audio file to verify it can be played on computer.DVI displays do not support audio through DVI connection, even when connected using Mini DisplayPort to DVI adapter.Always use known-good Mini DisplayPort or HDMI display equipped with internal speaker(s) to verify computer. If the display has a USB cable and connector, make sure it is also connected to computer.If using a Mini DisplayPort-to-HDMI adapter, verify that adapter supports audio on HDMI. Refer to HT202079: Send audio and video to HDMI displays through Mini DisplayPort.On the external display, verify that the correct input has been selected.In System Preferences > Displays, verify that external display is detected and enabled.In System Preferences > Sound > Output, select the available DisplayPort, HDMI, or USB Output device type, (depending on display model and connection).In System Preferences > Sound > Output, adjust output volume and balance levels.Test audio output using more than one application or website.Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Inspect the Thunderbolt receptacle for any signs of deformation, damage, or debris that may be blocking the connection. Use compressed air to clear any obstructions or debris.	Yes	Go to step 2.	<code>\$(nodeText.yesSymptomCode)</code>	
	Important: Do not use any metal objects to clear debris or obstructions, as this can short the connector and cause damage.	No	Go to step 3.	<code>\$(nodeText.noSymptomCode)</code>	
	Is the Thunderbolt port damaged?				

	Check	Result	Action	Code	Commodity
2.	Inspect the opening on the top case for the Thunderbolt receptacle. Determine whether the opening is misshapen or deformed, preventing proper insertion of Thunderbolt connectors.	Yes	<p>Replace the top case assembly.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	K16	KEYBOARD
	Is the opening for the Thunderbolt port damaged or deformed?	No	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M24	MLB
3.	Start up user's computer using known-good original system media or an up-to-date, bootable macOS volume. Check System Preferences > Sound > Output for an available DisplayPort, HDMI, or USB Output device type. Select available device type, adjust output volume level, and play audio file/source.	Yes	<p>Reinstall macOS on the user's computer. Refer to HT204319: macOS versions and builds included with Mac computers to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.</p>	`\${nodeText.yesSymptomCode}`	
	Can external display audio be enabled and play audio when user's computer has a known-good OS?	No	Go to step 4.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
4.	Connect a known-good, compatible Apple display adapter with audio support to computer's Thunderbolt port.	Yes	<p>The issue is isolated to the user's adapter.</p> <p>Replace the user's Apple display adapter.</p> <p>If user has third-party adapter, refer to manufacturer for support.</p>	X03	EXTERNAL CABLE
	<p>Connect a known-good display to user's computer using the appropriate adapter. Check System Preferences > Sound > Output for an available DisplayPort, HDMI, or USB Output device type. Select available device type, adjust output volume level, and play audio file/source.</p> <p>Can external display audio be enabled and play audio on user's computer?</p>	No	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M09	MLB
5.	Play a known-good audio file or source and verify that the sound output to display speakers is functional.	Yes	Issue resolved.	\${nodeText.yesSymptomCode}	
	<p>Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Is the issue resolved?</p>	No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	M99	

Thunderbolt Not Recognized

Unlikely causes:

Wireless card, battery, bottom case, display clamshell, fan, flash storage, heat sink, power adapter, top case, trackpad

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">Computer does not recognize Thunderbolt devices. <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables.</p>	<ol style="list-style-type: none">Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model.Using alternate network setup (for example, Wi-Fi or Apple USB Ethernet adapter), check for and apply the latest software and firmware updates.Check System Information > Hardware > Thunderbolt to verify that the Thunderbolt hardware is recognized.Try using a known-good Thunderbolt cable or adapter. See HT202488: Apple Thunderbolt cables and adapters.Try using a known-good Thunderbolt device or a Thunderbolt-capable computer in target disk mode. Refer to article HT201462: Use target disk mode to share files between two Mac computers.Refer to HT204154: Thunderbolt ports and displays: Frequently asked questions (FAQ).Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.Reset the SMC using the procedure for this computer in article HT201295: Reset the System Management Controller (SMC) on your Mac.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Inspect the Thunderbolt receptacle for any signs of deformation, damage, or debris that may be blocking the connection. Use compressed air to clear any obstructions or debris.	Yes	Go to step 2.	\$(nodeText.yesSymptomCode)	
	Important: Do not use any metal objects to clear debris or obstructions, as this can short the connector and cause damage.	No	Go to step 3.	\$(nodeText.noSymptomCode)	
	Is the Thunderbolt port damaged?				

	Check	Result	Action	Code	Commodity
2.	<p>Inspect the opening on the top case for the Thunderbolt receptacle. Determine whether the opening is misshapen or deformed, preventing proper insertion of Thunderbolt connectors.</p> <p>Is the opening for the Thunderbolt port damaged or deformed?</p>	Yes	<p>Replace the top case assembly.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	K16	KEYBOARD
		No	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M24	MLB
3.	<p>Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model. The correct build contains Thunderbolt drivers that match the logic board Thunderbolt controller.</p> <p>Is the proper OS version installed?</p>	Yes	Go to step 4.	`\${nodeText.yesSymptomCode}`	
		No	<p>Reinstall macOS on the user's computer. Refer to HT204319: macOS versions and builds included with Mac computers to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.</p>	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
4.	<p>Check for and apply the latest software and firmware updates. Check System Information > Hardware > Thunderbolt. If no device is connected, the Thunderbolt controller should be listed as the type of computer (for example, MacBook Air) with a unique user ID (UID) and firmware version shown.</p> <p>Does System Information list Thunderbolt hardware?</p>	Yes	Go to step 5.	\$(nodeText.yesSymptomCode}	
		No	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M33	MLB
5.	<p>Connect a known-good Thunderbolt device using a known-good Thunderbolt cable. Refresh System Information > Hardware > Thunderbolt. The Thunderbolt port status should change and show the connected Thunderbolt device.</p> <p>Does System Information list the connected Thunderbolt device?</p>	Yes	Issue cannot be duplicated.	\$(nodeText.yesSymptomCode}	
		No	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M33	MLB

	Check	Result	Action	Code	Commodity
6.	Check System Information to confirm that the Thunderbolt hardware is recognized and has a unique UID, the most recent firmware version, and the correct link status.	Yes	Issue resolved.	\${nodeText.yesSymptomCode}	
	<p>Run AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Is the issue resolved?</p>	No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	M99	

Thunderbolt Target Disk Mode Issues

Unlikely causes:

Wireless card, battery, bottom case, display clamshell, fan, flash storage, heat sink, power adapter, top case, trackpad

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">Computer does not initiate Thunderbolt target disk mode connection.Computer does not show Thunderbolt floating icon when booted with T key active. <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables.</p>	<ol style="list-style-type: none">1. Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model.2. Using alternate network setup (for example, Wi-Fi or Apple USB Ethernet adapter), check for and apply the latest software and firmware updates.3. Check System Information > Hardware > Thunderbolt to verify that the Thunderbolt hardware is recognized.4. Try using a known-good Thunderbolt cable or adapter. See HT202488: Apple Thunderbolt cables and adapters.5. Try using a known-good Thunderbolt device or a Thunderbolt-capable computer in target disk mode. Refer to article HT201462: Use target disk mode to share files between two Mac computers.6. Refer to HT204154: Thunderbolt ports and displays: Frequently asked questions (FAQ) to verify that the computer has the latest Thunderbolt firmware versions installed.7. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.8. Reset the SMC using the procedure for this computer in article HT201295: Reset the System Management Controller (SMC) on your Mac.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Inspect the Thunderbolt receptacle for any signs of deformation, damage, or debris that may be blocking the connection. Use compressed air to clear any obstructions or debris.	Yes	Go to step 2.	<code>\$(nodeText.yesSymptomCode)</code>	
	Important: Do not use any metal objects to clear debris or obstructions, as this can short the connector and cause damage. Is the Thunderbolt port damaged?	No	Go to step 3.	<code>\$(nodeText.noSymptomCode)</code>	

	Check	Result	Action	Code	Commodity
2.	<p>Inspect the opening on the top case for the Thunderbolt receptacle. Determine whether the opening is misshapen or deformed, preventing proper insertion of Thunderbolt connectors.</p> <p>Is the opening for the Thunderbolt port damaged or deformed?</p>	Yes	<p>Replace the top case assembly.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	K16	KEYBOARD
		No	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M24	MLB
3.	<p>Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model. The correct build contains Thunderbolt drivers that match the logic board Thunderbolt controller.</p> <p>Is the proper OS version installed?</p>	Yes	Go to step 4.	`\${nodeText.yesSymptomCode}`	
		No	<p>Reinstall macOS on the user's computer. Refer to HT204319: macOS versions and builds included with Mac computers to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.</p>	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
4.	<p>Check for and apply the latest software and firmware updates. Check System Information > Hardware > Thunderbolt. If no device is connected, the Thunderbolt controller should be listed as the type of computer (for example, MacBook Air) with a unique user ID (UID) and firmware version shown.</p> <p>Does System Information list Thunderbolt hardware?</p>	Yes	Go to step 5.	#{nodeText.yesSymptomCode}	
		No	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M33	MLB
5.	<p>Connect a known-good Thunderbolt device using a known-good Thunderbolt cable. Refresh System Information > Hardware > Thunderbolt. The Thunderbolt port status should change and show the connected Thunderbolt device.</p> <p>Does System Information list the connected Thunderbolt device?</p>	Yes	Go to step 6.	#{nodeText.yesSymptomCode}	
		No	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M33	MLB

	Check	Result	Action	Code	Commodity
6.	<p>To troubleshoot this issue completely, the following known-good parts are required:</p> <ul style="list-style-type: none"> Thunderbolt-capable Mac Thunderbolt to Thunderbolt cable <p>Do you have immediate access to each of these known-good parts?</p>	Yes	Go to step 7.	\${nodeText.yesSymptomCode}	
		No	<p>ESCALATION REQUIRED.</p> <p>Request ACS help checking latest updates and System Information > Hardware > Thunderbolt device tree.</p>	X99	
7.	<p>Start up a known-good Thunderbolt-capable Mac in target disk mode by holding down the T key. Connect the known-good computer to the user's computer using a known-good Thunderbolt cable. Start up the user's computer and verify if the hard drive of the known-good computer appears on the desktop of the user's computer.</p> <p>Does hard drive on known-good Mac mount to user's computer while using known-good cable?</p>	Yes	Go to step 9.	\${nodeText.yesSymptomCode}	
		No	Go to step 8.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
8.	<p>Verify that System Information > Hardware > Thunderbolt on user's computer lists Thunderbolt connection and target disk mode information for the known-good computer.</p> <p>Does System Information list Thunderbolt target disk mode information?</p>	Yes	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support. Inform ACS that user's computer cannot mount a known-good Thunderbolt TDM computer HDD to the OS desktop, while it does show a Thunderbolt connection in System Information.</p>	M99	
		No	<p>Thunderbolt hardware is present, but not fully functioning.</p> <p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M33	MLB
9.	Inspect user's Thunderbolt to Thunderbolt cable for physical damage, such as contamination or burnt connectors on either end of the cable.	Yes	Replace the Thunderbolt to Thunderbolt cable. Verify issue resolved.	X26	EXTERNAL CABLE
	Is user's Thunderbolt cable damaged?	No	Go to step 10.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
10.	Connect user's Thunderbolt to Thunderbolt cable to both computers. Start up the known-good computer in target disk mode by holding down the T key during startup. Restart user's computer and verify that the known-good computer's hard drive mounts to the desktop of user's computer.	Yes	Go to step 11.	\${nodeText.yesSymptomCode}	
	Does known-good computer's drive mount to user's desktop?	No	Replace the Thunderbolt to Thunderbolt cable. Verify issue resolved.	X26	EXTERNAL CABLE
11.	Continue verification of user's Thunderbolt to Thunderbolt cable. Start up user's computer in target disk mode by holding down the T key during startup. Restart the known-good computer and verify that user's computer's hard drive mounts to the desktop of the known-good computer.	Yes	The user's computer and Thunderbolt cable pass inspections. Thunderbolt target disk mode issue resolved.	\${nodeText.yesSymptomCode}	
	Does user's computer's drive mount to known-good computer's desktop?	No	Go to step 12.	\${nodeText.noSymptomCode}	
12.	Substitute a known-good Thunderbolt to Thunderbolt cable between the known-good computer and the user's computer. Restart user's computer in target disk mode by holding down the T key during startup. Restart the known-good computer and verify that user's computer's hard drive mounts to the desktop of the known-good computer.	Yes	Replace the Thunderbolt to Thunderbolt cable. Verify issue resolved.	X26	EXTERNAL CABLE
	Does user's computer's drive mount to known-good computer's desktop?	No	ESCALATION REQUIRED. Contact ACS for additional support. Inform ACS that user's computer can mount a known-good Thunderbolt TDM computer HDD, but cannot support being a TDM for other hosts.	M99	
13.	Check System Information to confirm that the Thunderbolt hardware is recognized and has a unique UID, the most recent firmware version, and the correct link status.	Yes	Issue resolved.	\${nodeText.yesSymptomCode}	
	Run AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain. Verify that the issue is resolved. Is the issue resolved?	No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	M99	

USB Port Not Recognized

Unlikely causes:

Wireless card, battery, bottom case, display clamshell, fan, flash storage, heat sink, power adapter, speakers, top case, trackpad

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">Standard USB devices not recognized or not powered when connected to computer's USB port(s).USB 3 devices not recognized or not powered when connected to computer's USB port(s). <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables.</p>	<ol style="list-style-type: none">Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model.Using alternate network setup (for example, Wi-Fi or Apple Thunderbolt Ethernet adapter), check for and apply the latest software and firmware updates.Verify that any USB hubs connected to the computer have sufficient power for a connected USB device.Check whether the user's USB device requires a specific driver to function properly.If the user is using a USB 3 device, review article HT201163: Using USB 3 devices with Mac computers.Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.Reset the SMC using the procedure for this computer in article HT201295: Reset the System Management Controller (SMC) on your Mac.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Inspect both left and right USB receptacles for any signs of deformation, damage, or debris that may be blocking the connection. Use compressed air to clear any obstructions or debris.	Yes	Go to step 2.	`\${nodeText.yesSymptomCode}`	
	Important: Do not use any metal objects to clear debris or obstructions, as this can short the connector and cause damage.	No	Go to step 4.	`\${nodeText.noSymptomCode}`	
	Is either USB port damaged?				

	Check	Result	Action	Code	Commodity
2.	<p>Inspect the openings on the top case for both USB receptacles. Determine whether either opening is misshapen or deformed, preventing proper insertion of USB connectors.</p> <p>Is either opening for the USB port damaged or deformed?</p>	Yes	<p>Replace the top case assembly.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	K16	KEYBOARD
		No	Go to step 3.	\$_{nodeText.noSymptomCode}	
3.	<p>The right USB port connector is part of the logic board, while the left one is part of the I/O board.</p> <p>Identify which USB port is damaged.</p> <p>Which USB port is damaged?</p>	Right USB port	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M24	MLB
		Left USB port	<p>Replace the I/O board.</p> <p>Verify that the issue is resolved.</p>	M24	OTHER BOARD

	Check	Result	Action	Code	Commodity
4.	<p>Start up the user's computer using a known-good, up-to-date, and bootable macOS volume.</p> <p>Connect a known-good USB device to the right USB port.</p> <p>Retest for device presence in System Information > USB.</p> <p>Then disconnect the known-good USB device from the right USB port and connect it to the left USB port.</p> <p>Retest for device presence in System Information > USB.</p>	Yes	<p>Reinstall macOS on the user's computer. Refer to HT204319: macOS versions and builds included with Mac computers to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.</p>	<p>{nodeText.yesSymptomCode}</p>	
	<p>Is the USB device detected on both USB ports when using a known-good OS?</p>	No	Go to step 5.	<p>{nodeText.noSymptomCode}</p>	
5.	<p>The right USB port connector is part of the logic board, while the left one is part of the I/O board.</p> <p>Identify which USB port is not detected or functioning.</p> <p>Which USB port is not detected or functioning?</p>	Right USB port	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	<p>M15</p>	<p>MLB</p>
		Left USB port	Go to step 6.	<p>{nodeText.noSymptomCode}</p>	
6.	<p>Remove the bottom case and disconnect battery. Disconnect the input/output (I/O) flex cable from the logic board and the I/O board .</p> <p>Inspect the cable and connectors for damage. Look for pinching or crimping, and damaged or bent pins.</p> <p>Does the I/O flex cable show signs of damage?</p>	Yes	Go to step 7.	<p>{nodeText.yesSymptomCode}</p>	
		No	Go to step 8.	<p>{nodeText.noSymptomCode}</p>	

	Check	Result	Action	Code	Commodity
7.	<p>Inspect the logic board and I/O board I/O connectors for damage.</p> <p>Is the connector on the logic board or I/O board also damaged?</p>	Yes	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	
		No	<p>Replace the I/O flex cable.</p> <p>Verify that the issue is resolved.</p>	X03	INTERNAL CABLE
8.	<p>While the I/O flex cable is removed, disconnect the I/O power cable from the logic board.</p> <p>Inspect the cable and connector for damage. Look for pinching or crimping, and damaged or bent pins.</p> <p>Does the I/O power cable show signs of damage?</p>	Yes	<p>Replace the I/O board.</p> <p>Verify that the issue is resolved.</p>	M24	OTHER BOARD
		No	Go to step 9.	\$(nodeText.noSymptomCode)	
9.	<p>Inspect the logic board I/O flex cable and power cable connectors for damage.</p> <p>Does either connector on the logic board show signs of damage?</p>	Yes	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M24	MLB
		No	Go to step 10.	\$(nodeText.noSymptomCode)	
10.	<p>Inspect the I/O board I/O flex cable connector for damage.</p> <p>Does the connector on the I/O board show signs of damage?</p>	Yes	<p>Replace the I/O board.</p> <p>Verify that the issue is resolved.</p>	M24	OTHER BOARD
		No	Go to step 11.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
11.	Reseat the I/O board flex cable and power cable connections to the logic board and I/O board.	Yes	Issue resolved by reseating the I/O flex cable or power cable.	\${nodeText.yesSymptomCode}	
	Reassemble computer, reconnect known-good USB device to left USB port, and retest for device presence in System Information.		Verify that the issue is resolved.		
	Is the USB device detected on the left USB port after reseating the I/O flex cable?	No	Go to step 12.	\${nodeText.noSymptomCode}	
12.	To completely troubleshoot this issue, the following known-good parts are required.	Yes	Go to step 13.	\${nodeText.yesSymptomCode}	
	<ul style="list-style-type: none"> I/O flex cable I/O board Do you have immediate access to each of these known-good parts?	No	Replace the I/O flex cable. Verify that the issue is resolved.		
13.	Substitute a known-good I/O flex cable.	Yes	Replace the I/O flex cable.	X03	INTERNAL CABLE
	Reassemble computer, reconnect known-good USB device to left USB port, and retest for device presence in System Information.		Verify that the issue is resolved.		
	Is the USB device detected with a known-good I/O flex cable?	No	Go to step 14.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
14.	<p>Substitute a known-good I/O board.</p> <p>Reassemble computer, reconnect known-good USB device to left USB port, and retest for device presence in System Information.</p> <p>Is the USB device detected with a known-good I/O board?</p>	Yes	<p>Replace the I/O board.</p> <p>Reinstall user's I/O flex cable.</p> <p>Verify that the issue is resolved.</p>	M15	OTHER BOARD
		No	<p>Replace the logic board.</p> <p>Reinstall user's I/O flex cable and I/O board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M15	MLB
15.	<p>Confirm that a known-good USB device is functional and recognized.</p> <p>Retest both USB ports with an USB 3 device.</p> <p>Check System Information for correct power allocation to USB device.</p> <p>Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Is the issue resolved?</p>	Yes	Issue resolved.	\${nodeText.yesSymptomCode}	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	M99	

External USB ODD Noisy

Unlikely causes:

There are no unlikely causes for this issue.

Quick Check

Symptoms	Quick Check
<p>Note: Be sure you understand what type of optical drive noise you should be concerned about, and what noises you can safely ignore. The following lists help distinguish normal, functional optical drive sounds from noises that may indicate drive malfunction.</p> <p>Typical noises include sounds made during the following activities:</p> <ul style="list-style-type: none">• Waking the computer from sleep• Burning a CD or DVD• Inserting a disc• Ejecting a disc• Importing (“ripping”) an audio CD in iTunes• Playing a DVD• Accessing an idle disc <p>Abnormal noises include the following:</p> <ul style="list-style-type: none">• Grinding• Loud, repeated clicking• Scraping sounds• Constantly seeking or cycling the eject mechanism with no disc inserted <p>Listen closely in a quiet environment for the following:</p> <ul style="list-style-type: none">• Noise during start up• Noise during operation• Noise when drive is copying or saving data <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables.</p>	<ol style="list-style-type: none">1. Verify that the user’s issue involves only abnormal sounds, as defined in symptoms.2. Make sure the Apple USB SuperDrive is sitting flat on a surface with the silver top facing upward. Do not attempt to operate the SuperDrive on its side or upside-down.3. Verify that there is not an additional label adhered to the disc which could cause the disc to lose balance and create excessive noise when rotating at high speed.4. Verify that the optical drive is actually an Apple USB SuperDrive, which has a longer USB cable (340 mm), and not a MacBook Air SuperDrive, which has a slightly shorter cable (250 mm) that may not reach iMac’s USB ports while sitting on a flat surface alongside iMac.5. Compare optical drive noise to a known-good equivalent Apple USB SuperDrive. Use sound samples in article HT201623: Mac notebooks with optical drives: Noises from the optical drive to compare.6. Verify that the noise issue does not involve waking the computer. When starting up or waking from sleep, the Apple USB SuperDrive may make unfamiliar noises. Refer to article HT201623: Mac notebooks with optical drives: Noises from the optical drive.7. Test the user’s optical disc in a known-good drive to rule out a media issue. Verify disc size and shape are within specification in article HT201788: Get help with the slot-loading SuperDrive on your Mac computer.8. Test Apple USB SuperDrive with known-good discs. Verify media is free to spin without scraping edge or surface of media.9. Verify noise during seek activity is excessive. Seek noise should subside once disc is mounted.10. Verify disc spin noise is excessive. Disc spin should cease 30 seconds after mounting disc in Finder.11. Inspect the Apple USB SuperDrive drive slot for obstructions such as debris or a stuck disc.12. Inspect the Apple USB SuperDrive USB cable and USB connector for damage.13. The Apple USB SuperDrive is designed exclusively for use with iMac, MacBook Pro (Retina, Mid 2012 and later), MacBook Air, and Mac mini (Early 2009 and later). USB ports on other computers may not provide sufficient power to enable proper operation of drive. Verify user’s configuration is supported.14. The Apple USB SuperDrive must be plugged directly into computer’s USB port, and cannot be used while connected to a USB hub.15. Leave the Apple USB SuperDrive connected to the user’s computer and restart the computer while pressing the mouse button or keyboard Eject key to cycle the optical drive.16. If the user is experiencing an issue using the Apple USB SuperDrive with Microsoft Windows, try starting the computer with the Apple USB SuperDrive already plugged in.17. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Check whether the Apple USB SuperDrive is constantly seeking or cycling eject mechanism with no optical disc inserted. Optical drive should perform only one reset sequence and then rest idly, ready for media. Does the optical drive spin, seek, and/or reset continuously without an optical disc inserted?	Yes	Replace the Apple USB SuperDrive. Verify issue resolved.	J04	OPTICAL
		No	Go to step 2.	`\${nodeText.noSymptomCode}`	
2.	Closely inspect the user's Apple USB SuperDrive to determine whether a disc or other debris is stuck inside. Is a disc or other debris stuck in the drive?	Yes	Go to step 3.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 4.	`\${nodeText.noSymptomCode}`	
3.	Refer to RP451: Apple USB SuperDrive to open the drive enclosure and remove any stuck disc, dust, debris, or other foreign materials. Retest the Apple USB SuperDrive by inserting, mounting, and ejecting a known-good optical disc. Is optical drive function fully restored?	Yes	Issue resolved by removing stuck disc or debris from drive. Verify resolution.	`\${nodeText.yesSymptomCode}`	
		No	Replace the Apple USB SuperDrive. Verify issue resolved.	J05	OPTICAL
4.	Insert a known-good optical disc, then eject the disc. Listen carefully to Apple USB SuperDrive disc handling. Eject noise should consist of a pop as disc is released from motor hub, then gear movement as motor pushes disc out of slot. Repeat test several times. Is disc eject noise abnormal and excessive over multiple trials?	Yes	Replace the Apple USB SuperDrive. Verify issue resolved.	J04	OPTICAL
		No	Go to step 5.	`\${nodeText.noSymptomCode}`	
5.	Disconnect the Apple USB SuperDrive and retest for computer noise. Has the noise been eliminated?	Yes	Go to step 6.	`\${nodeText.yesSymptomCode}`	
		No	Go to "Noise / Hum / Vibration" troubleshooting flow.	`\${nodeText.noSymptomCode}`	
6.	To troubleshoot this issue completely, you will need an identical, known-good Apple USB SuperDrive with which to compare optical drive sounds. Do you have immediate access to a known-good Apple USB SuperDrive?	Yes	Go to step 7.	`\${nodeText.yesSymptomCode}`	
		No	Replace Apple USB SuperDrive. Verify issue resolved.	J04	OPTICAL

	Check	Result	Action	Code	Commodity
7.	Substitute a known-good Apple USB SuperDrive and retest.	Yes	Replace Apple USB SuperDrive. Verify issue resolved.	J04	OPTICAL
	Has the noise been eliminated?	No	Go to “Noise / Hum / Vibration” troubleshooting flow.	\${nodeText.noSymptomCode}	
8.	Verify Apple USB SuperDrive does not make any abnormal noises.	Yes	Issue resolved.	\${nodeText.yesSymptomCode}	
	Is the issue resolved?	No	Go to “Noise / Hum / Vibration” troubleshooting flow.	\${nodeText.noSymptomCode}	

External USB ODD Not Recognized

Unlikely causes:

There are no unlikely causes for this issue.

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">Discs cannot be inserted.Discs can be inserted, but are ejected immediately.Discs can be inserted, but are ejected after drive has spun up for some seconds.Discs can be inserted and ejected, but do not appear in the Finder. <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables.</p>	<ol style="list-style-type: none">Go to Finder Preferences > General and make sure “CDs, DVDs, and iPods” is checked under “Show these items on the desktop.”Make sure the Apple USB SuperDrive is sitting flat on a surface with the silver top facing upward. Do not attempt to operate the SuperDrive on its side or upside-down.Verify that the optical drive is actually an Apple USB SuperDrive, which has a longer USB cable (340 mm), and not a MacBook Air SuperDrive, which has a slightly shorter cable (250 mm) that may not reach iMac’s USB ports while sitting on a flat surface alongside iMac.Inspect the Apple USB SuperDrive drive slot for obstructions (stuck disc, for example)Inspect the Apple USB SuperDrive USB cable and USB connector for damage.The Apple USB SuperDrive is designed exclusively for use with iMac, MacBook Pro (Retina, Mid 2012 and later), MacBook Air, and Mac mini (Early 2009 and later). USB ports on other computers may not provide sufficient power to enable proper operation of drive. Verify user’s configuration is supported.The Apple USB SuperDrive must be plugged directly into the computer’s USB port, and cannot be used while connected to a USB hub.Leave the Apple USB SuperDrive connected to the user’s computer and restart the computer while pressing the mouse button or keyboard Eject key to cycle the optical drive.If the user is experiencing an issue using the Apple USB SuperDrive with Microsoft Windows, try starting the computer with the Apple USB SuperDrive already plugged in.Refer to article HT201788: Get help with the slot-loading SuperDrive on your Mac computer.Connect the user’s Apple USB SuperDrive to a known-good iMac, MacBook Pro (Retina, Mid 2012 and later), MacBook Air, or Mac mini (Early 2009 and later) to verify drive’s functionality separately from user’s computer.Disconnect the user’s Apple USB SuperDrive and connect a known-good Apple USB SuperDrive to the same USB port on the user’s computer to verify the computer’s functionality separately from the user’s drive. If the issue persists, troubleshoot as a faulty USB port on the user’s computer.Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	<p>Connect the user's Apple USB SuperDrive to an available USB port on user's computer and start up the computer. Check System Information > Hardware > USB device tree to verify the presence of the optical drive.</p> <p>Repeat this process using each USB port on the user's computer to verify all of the computer's USB ports are functioning.</p> <p>Does drive appear in System Information when connected to every USB port?</p>	Yes	Go to step 2.	`\${nodeText.yesSymptomCode}`	
		No	Go to "USB Port Not Recognized" troubleshooting flow.	`\${nodeText.noSymptomCode}`	
2.	<p>Attempt to insert a known-good, properly formatted CD or DVD disc into the Apple USB SuperDrive. Check whether the disc auto-ejects either immediately or within a few seconds after the drive has spun up.</p> <p>Does disc auto-eject shortly after insertion?</p>	Yes	Replace the Apple USB SuperDrive. Verify issue resolved.	J01	OPTICAL
		No	Go to step 3.	`\${nodeText.noSymptomCode}`	
3.	<p>After insertion, verify that the disc spins and the disc volume mounts in the Finder.</p> <p>Does drive mount a known-good disc?</p>	Yes	Go to step 4.	`\${nodeText.yesSymptomCode}`	
		No	Replace Apple USB SuperDrive. Verify issue resolved.	J09	OPTICAL
4.	<p>Check to see whether the Apple USB SuperDrive properly mounts and reads both known-good CD and DVD media.</p> <p>If only one type of media is recognized, there may be a laser issue.</p> <p>Can drive read both media types?</p>	Yes	Issue resolved.	`\${nodeText.yesSymptomCode}`	
		No	Go to "External USB ODD Read/Write or Performance Issues" troubleshooting flow.	`\${nodeText.noSymptomCode}`	
5.	<p>Insert, mount, and eject both a known-good CD and DVD.</p> <p>Is the issue resolved?</p>	Yes	Issue resolved.	`\${nodeText.yesSymptomCode}`	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	J99	

External USB ODD Read/Write or Performance Issues

Unlikely causes:

There are no unlikely causes for this issue.

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• Errors when writing to optical media• Errors when reading from optical media• Hangs when accessing or writing data• Read or write speeds slower than expected <p>Note: Inform the user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables.</p>	<ol style="list-style-type: none">1. Test the user's optical disc in a known-good drive to rule out a media issue. Verify disc size and shape are within specification in article HT201788: Get help with the slot-loading SuperDrive on your Mac computer.2. Test known-good, compatible optical media in user's Apple USB SuperDrive connected to a known-good computer.3. Go to System Information > Hardware > Disc Burning to compare actual disc burning specifications to user's expectations.4. See articles HT2543: About optical disc drive burning and write speeds and HT2882: Factors that affect writing to or reading from optical media to learn more about disc burning and how performance is affected by write speeds, media types, software, and more.5. Make sure the Apple USB SuperDrive is sitting flat on a surface with the silver top facing upward. Do not attempt to operate the SuperDrive on its side or upside-down.6. Verify that the optical drive is actually an Apple USB SuperDrive, which has a longer USB cable (340 mm), and not a MacBook Air SuperDrive, which has a slightly shorter cable (250 mm) that may not reach iMac's USB ports while sitting on a flat surface alongside iMac.7. Inspect the Apple USB SuperDrive drive slot for obstructions (stuck disc, for example).8. Inspect the Apple USB SuperDrive USB cable and USB connector for damage.9. The Apple USB SuperDrive is designed exclusively for use with iMac, MacBook Pro (Retina, Mid 2012 and later), MacBook Air, and Mac mini (Early 2009 and later). USB ports on other computers may not provide sufficient power to enable proper drive operation. Verify user's configuration is supported.10. The Apple USB SuperDrive must be directly plugged into the computer's USB port and cannot be used while connected to a USB hub.11. With the Apple USB SuperDrive connected to the user's computer, restart the computer while pressing the mouse button or Eject key to cycle the optical drive.12. If the user is experiencing an issue using the Apple USB SuperDrive with Microsoft Windows, try starting the computer with the Apple USB SuperDrive already plugged in.13. Refer to article HT201788: Get help with the slot-loading SuperDrive on your Mac computer.14. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Connect the user's Apple USB SuperDrive to an available USB port on the user's computer and start up the computer. Insert media into the Apple USB SuperDrive and listen for scraping/scratching noises as the disc spins up. Eject the disc and examine its surface and edges for scrapes or scratches. Verify that the disc can spin without the optical drive scraping the edge or surface of the media. Does media spin freely in the drive?	Yes	Go to step 2.	\$(nodeText.yesSymptomCode)	
		No	Replace the Apple USB SuperDrive. Verify issue resolved.	J05	OPTICAL
2.	Closely inspect the user's Apple USB SuperDrive to determine if a disc or other debris is stuck inside. Is a disc or other debris stuck in the drive?	Yes	Go to step 3.	\$(nodeText.yesSymptomCode)	
		No	Go to step 4.	\$(nodeText.noSymptomCode)	
3.	Refer to RP451: Apple USB SuperDrive to open the drive enclosure and remove any stuck disc, dust, debris, or other foreign materials. Retest the Apple USB SuperDrive by inserting, mounting, and ejecting a known-good optical disc. Is optical drive function fully restored?	Yes	Issue resolved by removing stuck disc or debris from drive. Verify resolution.	\$(nodeText.yesSymptomCode)	
		No	Replace the Apple USB SuperDrive. Verify issue resolved.	J05	OPTICAL
4.	Verify that the optical drive can properly read known-good CDs. Can the optical drive read CDs?	Yes	Go to step 5.	\$(nodeText.yesSymptomCode)	
		No	Go to step 6.	\$(nodeText.noSymptomCode)	
5.	Verify that the optical drive can properly read known-good DVDs. Can the optical drive read DVDs?	Yes	Go to step 7.	\$(nodeText.yesSymptomCode)	
		No	Go to step 6.	\$(nodeText.noSymptomCode)	
6.	Check System Information > Hardware > USB to verify presence of optical drive. Does the optical drive appear in System Information?	Yes	Go to step 7.	\$(nodeText.yesSymptomCode)	
		No	Go to “External USB ODD Not Recognized” troubleshooting flow.	\$(nodeText.noSymptomCode)	
7.	Burn test data to CD and DVD media compatible with the Apple USB SuperDrive. Verify that the burned media is recognized and readable by the drive. Can the optical drive read its own burned media?	Yes	Go to step 8.	\$(nodeText.yesSymptomCode)	
		No	Replace the Apple USB SuperDrive. Verify issue resolved.	J03	OPTICAL

	Check	Result	Action	Code	Commodity
8.	<p>To troubleshoot this issue completely, you will need an identical, known-good Apple USB SuperDrive with which to compare optical disc read and burn times.</p> <p>Do you have immediate access to a known-good Apple USB SuperDrive?</p>	Yes	Go to step 9.	\$(nodeText.yesSymptomCode}	
		No	Replace the Apple USB SuperDrive. Verify issue resolved.	J07	OPTICAL
9.	<p>Using the same media type and brand, compare read and burn times of the user's Apple USB SuperDrive connected to a known-good computer, against a known-good Apple USB SuperDrive connected to the same computer.</p> <p>Does the user's drive have significantly longer read or burn times than a known-good drive?</p>	Yes	Replace the Apple USB SuperDrive. Verify issue resolved.	J07	OPTICAL
		No	Issue resolved.	\$(nodeText.noSymptomCode}	
10.	<p>Test all Apple USB SuperDrive functions and drive performance to verify a successful repair.</p> <p>Is the issue resolved?</p>	Yes	Issue resolved.	\$(nodeText.yesSymptomCode}	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	J99	

External USB ODD Rejects, Does Not Accept, or Does Not Eject Media

Unlikely causes:

There are no unlikely causes for this issue.

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• Cannot insert a disc into the drive.• Cannot eject a disc from the drive.• Drive ejects discs immediately after insertion. <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables.</p>	<ol style="list-style-type: none">1. Test the user's optical disc in a known-good drive to rule out a media issue. Verify disc size and shape are within specification in article HT201788: Get help with the slot-loading SuperDrive on your Mac computer.2. Connect the user's Apple USB SuperDrive to a known-good iMac, MacBook Pro (Retina, Mid 2012 or later), MacBook Air, or Mac mini (Early 2009 or later) to verify drive's functionality separately from user's computer.3. Disconnect the user's Apple USB SuperDrive and connect a known-good Apple USB SuperDrive to the same USB port on the user's computer to verify the computer's functionality separately from the user's drive. If the issue persists, troubleshoot as a faulty USB port on the user's computer.4. Make sure the Apple USB SuperDrive is sitting flat on a surface with the silver top facing upward. Do not attempt to operate the SuperDrive on its side or upside-down.5. Verify that optical drive is actually an Apple USB SuperDrive, which has a longer USB cable, and not a MacBook Air SuperDrive, which has a slightly shorter cable that may not reach iMac's USB ports while sitting on a flat surface alongside the computer.6. Inspect the Apple USB SuperDrive drive slot for obstructions (stuck disc, for example).7. Inspect the Apple USB SuperDrive USB cable and USB connector for damage.8. The Apple USB SuperDrive is designed exclusively for use with iMac, MacBook Pro (Retina, Mid 2012 or later), MacBook Air, and Mac mini (Early 2009 or later). USB ports on other computers may not provide sufficient power to enable proper operation of drive. Verify user's configuration is supported.9. The Apple USB SuperDrive must be plugged directly into the computer's USB port, and cannot be used while connected to a USB hub.10. Leave the Apple USB SuperDrive connected to the user's computer and restart the computer while pressing the mouse button or keyboard Eject key to cycle the optical drive.11. If the user is experiencing an issue using the Apple USB SuperDrive with Microsoft Windows, try starting the computer with the Apple USB SuperDrive already plugged in.12. Refer to article HT201788: Get help with the slot-loading SuperDrive on your Mac computer.13. Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Connect the user's Apple USB SuperDrive to an available USB port on the user's computer and start up the computer. Check System Information > Hardware > USB to verify presence of optical drive. Does the optical drive appear in System Information?	Yes	Go to step 2.	\$(nodeText.yesSymptomCode)	
		No	Go to “External USB ODD Not Recognized” troubleshooting flow.	\$(nodeText.noSymptomCode)	
2.	Closely inspect the user's Apple USB SuperDrive to determine if a disc or other debris is stuck inside. Is a disc or other debris stuck in the drive?	Yes	Go to step 13.	\$(nodeText.yesSymptomCode)	
		No	Go to step 3.	\$(nodeText.noSymptomCode)	
3.	Verify known-good disc can fit through enclosure slot. Is clearance in enclosure slot sufficient for disc insertion?	Yes	Go to step 5.	\$(nodeText.yesSymptomCode)	
		No	Go to step 4.	\$(nodeText.noSymptomCode)	
4.	Closely inspect entire Apple USB SuperDrive enclosure for dents, scratches, or other indications of impact or abuse. Is insufficient clearance due to accidental damage?	Yes	Go to step 14.	\$(nodeText.yesSymptomCode)	
		No	Replace the Apple USB SuperDrive. Verify issue resolved.	J01	OPTICAL
5.	Inspect the slot on the optical drive assembly for proper disc clearance. Is clearance in optical drive slot sufficient for disc insertion?	Yes	Go to step 10.	\$(nodeText.yesSymptomCode)	
		No	Go to step 6.	\$(nodeText.noSymptomCode)	
6.	When a CD or DVD pops off the spindle inside an optical drive (usually due to impact to the drive) and remains in the drive mechanism, the loose disc prevents the slot from being able to open fully, creating a “closed condition.” Inspect the slot in the optical drive to determine if it is “closed” (not accepting discs). If the disc slot is closed, inspect the drive mechanism, especially the drive enclosure, for evidence of drop damage. Note: If the disc slot is closed, but there is no sign of accidental damage, choose “NO” to the question below. Is disc slot access closed due to accidental damage?	Yes	Go to step 14.	\$(nodeText.yesSymptomCode)	
		No	Go to step 7.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
7.	Inspect the slot in the Apple USB SuperDrive to determine if it is “closed” (not accepting discs) because of a stuck disc. Is disc slot access closed because of a stuck disc?	Yes	Go to step 13.	\$(nodeText.yesSymptomCode)	
		No	Go to step 8.	\$(nodeText.noSymptomCode)	
8.	Make sure the optical drive assembly is mounted into the enclosure correctly and is properly aligned with the enclosure slot opening. Is the drive assembly properly aligned with the enclosure slot opening?	Yes	Go to step 10.	\$(nodeText.yesSymptomCode)	
		No	Go to step 9.	\$(nodeText.noSymptomCode)	
9.	Refer to RP451: Apple USB SuperDrive to open the drive enclosure and align the optical drive assembly with the enclosure’s bezel slot. Retest the Apple USB SuperDrive by inserting, mounting and ejecting a known-good optical disc. Is optical drive function fully restored?	Yes	Issue resolved. Apple USB SuperDrive alignment realigned disc inject function. Verify issue resolved.	\$(nodeText.yesSymptomCode)	
		No	Replace the Apple USB SuperDrive. Verify issue resolved.	J01	OPTICAL
10.	Attempt to insert a known-good, properly formatted CD or DVD disc into the Apple USB SuperDrive. Check whether the disc auto-ejects either immediately or within a few seconds after the drive has spun up. Does the disc immediately auto-eject?	Yes	Replace the Apple USB SuperDrive. Verify issue resolved.	J01	OPTICAL
		No	Go to step 11.	\$(nodeText.noSymptomCode)	
11.	After insertion, verify that the disc spins and the disc volume mounts in the Finder. Does the disc volume mount?	Yes	Go to step 12.	\$(nodeText.yesSymptomCode)	
		No	Go to “External USB ODD Read/Write or Performance Issues” troubleshooting flow.	\$(nodeText.noSymptomCode)	
12.	Eject the disc by dragging the disc icon to Trash or selecting the disc icon and pressing the Eject key or Command-E on the keyboard. Does the disc eject properly?	Yes	Issue resolved.	\$(nodeText.yesSymptomCode)	
		No	Replace the Apple USB SuperDrive. Verify issue resolved.	J02	OPTICAL

	Check	Result	Action	Code	Commodity
13.	Refer to RP451: Apple USB SuperDrive to open the drive enclosure and remove any stuck disc, dust, debris, or other foreign materials.	Yes	Issue resolved by removing stuck disc or debris from drive. Verify resolution.	\$(nodeText.yesSymptomCode)	
	Retest the Apple USB SuperDrive by inserting, mounting, and ejecting a known-good optical disc. Is optical drive function fully restored?	No	Go to step 14.	\$(nodeText.noSymptomCode)	
14.	Inform user that computer failures due to accidental damage are not covered under any Apple warranty, including AppleCare. If applicable, discuss out-of-warranty repair options.	Yes	Replace the Apple USB SuperDrive. Verify issue resolved.	J05	OPTICAL
	Does user want to proceed with out-of-warranty repair?	No	Issue resolved. Using proper positioning, return the drive to the user.	\$(nodeText.noSymptomCode)	
15.	Insert, mount, and eject a known-good optical disc. Is the issue resolved?	Yes	Issue resolved.	\$(nodeText.yesSymptomCode)	
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	J99	

Flash Storage Not Recognized / Not Mounting / Read/Write Issues

Unlikely causes:

Wireless card, battery, bottom case, display clamshell, fan, heat sink, power adapter, speaker, top case, trackpad

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">Boots to gray screen.Boots to blue screen.Displays a flashing folder with question mark or prohibitory symbol.Cannot save documents.Displays read/write error message(s).Hangs when accessing or saving data. <p>Important: Always ask if user's data has been backed up prior to repair.</p> <p>Note: Inform the user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: Determining and quoting accidental damage for Mac portables.</p>	<p>Important: Always ask if the user's data has been backed up before beginning the repair.</p> <p>Important: Some Macs that have been updated to macOS High Sierra may not start up to the internal startup volume after logic board replacement. On affected Macs, the Mac BootROM Updater is available to address this issue. This utility updates the EFI BootROM on affected Macs to allow starting up to a volume that has been updated to the APFS file system.</p> <p>If the user's computer does not start up to the internal startup volume after logic board replacement, run the Mac BootROM Updater to ensure the replacement logic board's EFI BootROM firmware is updated to the latest version that supports the APFS file system.</p> <p>For more information and instructions for downloading and using the Mac BootROM Updater, see article OP476: Latest Apple Service Toolkit download links and documentation.</p> <ol style="list-style-type: none">Disconnect all peripherals and attempt to start up the computer.To restore the default startup disk, reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.Reset the SMC using the procedure listed for this computer in article HT201295: How to reset the System Management Controller (SMC) on your Mac.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Verify that the computer will start up and boot to macOS.	Yes	Go to step 3.	\$(nodeText.yesSymptomCode)	
	If the computer is not booting to the internal drive, start up the computer using a known-good, bootable macOS volume. Refer to article HT201260: How to find the macOS version number on your Mac to determine the correct minimum build for this computer.	No	Go to step 2.	\$(nodeText.noSymptomCode)	
	During startup, allow up to four minutes for a defective flash storage to time out, after which the computer will start up from a known-good external device.				
	Does the computer start up from a known-good volume?				

	Check	Result	Action	Code	Commodity
2.	Disconnect flash storage card from logic board.	Yes	Go to step 9.	\$(nodeText.yesSymptomCode)	
	Start up the computer using a known-good, bootable macOS volume. Does the computer start up from a known-good volume?	No	Go to the “Will Not Start Up” troubleshooting flow.	\$(nodeText.noSymptomCode)	
3.	Run MRI and Storage Diagnostic via AST 2 to verify the functionality of the built-in flash storage.	Yes	Go to step 5.	\$(nodeText.yesSymptomCode)	
	Check only for any storage errors reported. Do the diagnostic results show errors with storage?	No	Go to step 4.	\$(nodeText.noSymptomCode)	
4.	Use the results from the AST 2 diagnostics to determine the macOS build version that is installed on the computer. Refer to HT201260: How to find the macOS version number on your Mac to check that the system build is correct for this computer model. Is the correct version of macOS installed on the user's drive?	Yes	ESCALATION REQUIRED. If you suspect a problem even though Storage Diagnostics gives a passing result, contact ACS for additional support.	H99	
		No	Reinstall macOS on the user's computer. Refer to HT201260: How to find the macOS version number on your Mac to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.	\$(nodeText.noSymptomCode)	
5.	Examine the diagnostic results via AST 2. Check whether the only result indicated an issue with the file system.	Yes	Go to step 6.	\$(nodeText.yesSymptomCode)	
	Is the only reported error an issue with the file system?	No	Go to step 8.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
6.	Start up the computer to Internet Recovery or a known-good bootable macOS volume. Use Disk Utility to repair the user's internal flash storage volume.	Yes	The issue was resolved by repairing the volume using Disk Utility.	\${nodeText.yesSymptomCode}	
	Attempt to start up from the user's internal flash storage.		Verify that the issue is resolved.		
	Does the computer start up successfully from the user's internal flash storage?	No	Go to step 7.	\${nodeText.noSymptomCode}	
7.	Start up the computer to Internet Recovery or a known-good bootable macOS volume. Run Disk Utility and select the user's flash storage drive, then choose the Partition tab.	Yes	The issue was resolved by reinstalling macOS.	\${nodeText.yesSymptomCode}	
	Follow all steps listed in HT204743: Partition a problematic drive two times before recommending service or replacement .		Verify that the issue is resolved.		
	This will force a rewrite of the partitions table.	No	Go to step 9.	\${nodeText.noSymptomCode}	
	Reinstall macOS on the user's computer. Refer to HT201260: How to find the macOS version number on your Mac to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates.				
	Does the computer start up successfully from the user's internal flash storage?				
8.	Examine the diagnostic results via AST 2. Check whether the storage device failed the Device Detection Test.	Yes	Replace the logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Run AST 2 Trackpad Calibration Check to verify the proper functionality of the trackpad, as well as recalibrate it if necessary. Refer to TP1314: Trackpad Calibration Check for instructions. Verify the issue is resolved.	M19	MLB
	Did the storage device fail the Device Detection Test?	No	Go to step 9.		

	Check	Result	Action	Code	Commodity
9.	Remove the bottom case and disconnect battery.	Yes	Go to step 10.	\${nodeText.yesSymptomCode}	
	Disconnect and inspect flash storage. Look for damage on logic board connector and flash storage.				
	Look for connector pin damage and missing or bent pins on logic board connector that could prevent correct seating.	No	Go to step 11.	\${nodeText.noSymptomCode}	
	Did you find damage to flash storage or logic board connectors?				
10.	Inspect the logic board flash storage connector for damage.	Yes	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	H99	
	Is the connector on the logic board also damaged?	No	Replace the user's flash storage card. Verify that the issue is resolved.	H04	SSD
11.	Reconnect user's flash storage. Verify that the flash storage module is properly seated to the logic board connector.	Yes	The issue was resolved by reseating flash storage. Verify resolution.	\${nodeText.yesSymptomCode}	
	Run AST Storage Diagnostic on the user's computer again and examine the results of the test.	No	Go to step 12.	\${nodeText.noSymptomCode}	
12.	Do all internal drive tests pass in Storage Diagnostic?				
	To troubleshoot this issue completely, a known-good bootable flash storage card is required.	Yes	Go to step 13.	\${nodeText.yesSymptomCode}	
	Do you have immediate access to a known-good flash storage card?	No	Replace the user's flash storage card. Verify that the issue is resolved.	H05	SSD

	Check	Result	Action	Code	Commodity
13.	<p>Substitute known-good flash storage.</p> <p>Run AST Storage Diagnostic on the user's computer again and examine the results of the test.</p> <p>Do all internal drive tests pass in Storage Diagnostic?</p>	Yes	<p>Replace the user's flash storage card.</p> <p>Verify that the issue is resolved.</p>	H05	SSD
		No	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M05	MLB
14.	<p>Verify that the computer can successfully start up from internal flash storage.</p> <p>Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Is the issue resolved?</p>	Yes	The issue is resolved. Verify resolution.	`\${nodeText.yesSymptomCode}`	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	

Burnt Smell / Odor

Unlikely causes:

There are no unlikely causes for this issue.

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">Computer or power adapter emits a burnt, smoky, or other unusual odor. <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables.</p>	<ol style="list-style-type: none">Disconnect the power adapter and any peripherals from the computer.Remove bottom case and disconnect battery cable from logic board.Determine whether this is a safety issue. Refer to article OP44: SERVICE: Handling Potential Product Safety Issues.Inspect enclosure and components for obvious signs of burning or smoky residue. Check rear vents, keyboard, slots, and ports, as well as the power adapter, MagSafe 2 connector, and cable. Refer to article HT203529: Smoke emitted may be from failed component.Clean the enclosure to eliminate any causes due to external contamination.Verify that the vents allow unobstructed airflow into and out of the computer.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Closely inspect the computer for a possible safety issue. Have you identified a safety issue?	Yes	ESCALATION REQUIRED. Contact ACS for safety-related issues. Refer to article OP44: SERVICE: Handling Potential Product Safety Issues .	X99	
		No	Go to step 2.	`\${nodeText.noSymptomCode}`	
2.	Odor can be related to external contamination. Inspect the computer exterior for contamination or lack of cleanliness. Can you determine that the odor is caused by external contamination?	Yes	Go to step 3.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 4.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
3.	<p>Thoroughly clean enclosure and all external surfaces. Refer to article HT204172: Clean your Apple products. Explain the cause to the user.</p> <p>Does user agree that the odor is due to external contamination?</p>	Yes	Issue resolved. Verify resolution.	`\${nodeText.yesSymptomCode}`	
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	
4.	<p>Odors can be related to how new the product is. Refer to article HT202324: New equipment: Odors may be present short-term.</p> <p>Can you determine that the odor is due to the product being new?</p>	Yes	Go to step 5.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 6.	`\${nodeText.noSymptomCode}`	
5.	<p>Explain to the user that new computers can sometimes emit an odor, similar to odors generated from new carpeting or a new car. In most cases, the odor dissipates after a brief period.</p> <p>Refer to article HT202324: New equipment: Odors may be present short-term.</p> <p>Does the user agree that the odor is related to the computer being new?</p>	Yes	Issue resolved. Verify resolution.	`\${nodeText.yesSymptomCode}`	
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	
6.	<p>Closely inspect internal components and enclosure for indications of physical damage or contamination.</p> <p>Can you identify signs of internal damage or contamination?</p>	Yes	Go to the “Mechanical / Physical / Cosmetic Damage” troubleshooting flow.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 7.	`\${nodeText.noSymptomCode}`	
7.	<p>Refer to TP1150: Visual/Mechanical Inspection (VMI) Guide for Mac Portables Liquid Damage for guidance regarding possible liquid damage to the user’s computer.</p> <p>Does the computer exhibit this type of damage?</p>	Yes	Go to the “Mechanical / Physical / Cosmetic Damage” troubleshooting flow.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 8.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
8.	<p>Closely inspect internal hardware and enclosure for other possible causes of odor, such as bulging or vented capacitor chips; and visible residue and/or burn marks on the enclosure, logic board, or other components.</p> <p>Have you identified a component failure as the source of the odor?</p>	Yes	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	
		No	The issue cannot be duplicated.	\${nodeText.noSymptomCode}	
9.	<p>Run the computer for several hours and monitor for the issue/odor.</p> <p>Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>If no functional failure is detected, use correct positioning to explain to the user that the odor is related to external contamination or the computer being new.</p> <p>Is the issue resolved?</p>	Yes	Issue resolved.	\${nodeText.yesSymptomCode}	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	

Computer Runs Hot

Unlikely causes:

Bottom case, power adapter, speakers, top case

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• Computer feels unusually warm.• Fan is not operating.• Fan is not functioning to its full capacity.• Fan runs constantly at high speeds. <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables.</p>	<ol style="list-style-type: none">1. Run Mac Resource Inspector (MRI) to verify correct operation of sensors and fan(s).2. Check for and apply latest software and firmware updates.3. Verify temperature issue with computer resting on a hard, flat surface. Note: Use this opportunity to educate user about inappropriate working surfaces that may cause computer to overheat. Refer to article HT201640: Mac notebooks: Operating Temperature.4. Inspect fan performance during operation to make sure fan is spinning. Check whether vents are blocked. If necessary, use compressed air to remove dust or debris from rear fan exhaust.5. Compare computer's operating temperature to a known-good, similarly configured computer.6. Check for runaway applications using article HT203184: Runaway applications can shorten battery runtime, affect performance, and increase heat and fan activity. Follow instructions to halt any processes that are using excessive system resources.7. Processor-intensive/graphics-intensive applications and system processes may cause bottom case to feel warm. Use Activity Monitor to identify these types of programs and explain the issue to user.8. Reset SMC using procedure listed for this computer in article HT201295: Intel-based Macs: Resetting the System Management Controller (SMC).9. Verify computer's internal SSD card or flash storage is an Apple-installed part. Check this in MRI or compare hard drive information in System Information to article SM155: Hard Drives Matrix to determine if user's installed drive is one of the OEM drives available for this computer configuration. Third-party flash storage without correct firmware or outside this product's specifications may cause computer to run hot. In such cases, inform user that computer has been modified from its original, supported configuration, and that such a repair would not be covered under Apple warranty.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Run Mac Resource Inspector (MRI) to check for correct fan operation and current status of thermal sensors. MRI will report a failure if a fan is not rotating, or if a sensor is undetected or exceeding thermal values.	Yes	Go to step 2.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 8.	`\${nodeText.noSymptomCode}`	
	Does computer pass all MRI checks?				

	Check	Result	Action	Code	Commodity
2.	Use Cooling System Diagnostic (CSD) to verify proper function of the following subsystems: <ul style="list-style-type: none"> • SMC • Fans • Thermal sensors • CPU—heat sink thermal interface 	Yes	Computer passed all CSD checks. Verify operation and refer customer to article HT201640: Mac notebooks: Operating Temperature .	\$(nodeText.yesSymptomCode)	
	Does computer pass all CSD checks?	No	Go to step 3.	\$(nodeText.noSymptomCode)	
3.	Remove fan to reveal inner side of heat sink. Use an ESD-safe vacuum to remove dust or debris from inner side of heat sink fin stack. Reinstall fan and reseat fan cable connection to logic board. Retest using CSD.	Yes	Issue resolved by cleaning airflow. Verify resolution.	\$(nodeText.yesSymptomCode)	
	Does computer pass all CSD checks?	No	Go to step 4.	\$(nodeText.noSymptomCode)	
4.	To troubleshoot this issue completely, a known-good fan is required.	Yes	Go to step 5.	\$(nodeText.yesSymptomCode)	
	Do you have immediate access to known-good fan?	No	Replace fan. Verify issue resolved.	X22	OTHER ELECTRIC
5.	Substitute a known-good fan or fans and retest using MRI and CSD.	Yes	Replace fan. Verify issue resolved.	X22	OTHER ELECTRIC
	Does known-good fan pass CSD tests?	No	Go to step 6.	\$(nodeText.noSymptomCode)	
6.	To troubleshoot this issue completely, a known-good logic board is required. Do you have immediate access to a known-good logic board?	Yes	Go to step 7.	\$(nodeText.yesSymptomCode)	
		No	Replace the logic board. Reinstall user's fan. Use Blank Board Serializer (BBS) to set the computer's serial number. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	M18	MLB

	Check	Result	Action	Code	Commodity
7.	<p>Continue to use known-good fan. Substitute a known-good logic board, using new thermal material with user's heat sink. Reinstall heat sink onto logic board, tightening heat sink screws with sufficient torque. If a thermal sensor is present on heat sink, make sure it is properly reconnected to logic board. Reassemble computer and retest.</p> <p>Do both known-good fan and logic board pass diagnostics?</p>	Yes	<p>Replace the logic board.</p> <p>Reinstall user's fan.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M18	MLB
		No	<p>Replace heat sink on user's logic board with new thermal material. Verify issue resolved.</p>	X10	OTHER ELECTRIC
8.	<p>A disconnected fan will prevent proper cooling and cause thermal sensors to exceed expected values.</p> <p>Do diagnostics report a fan motor test failure?</p>	Yes	Go to step 9.	\${nodeText.yesSymptomCode}	
		No/Other	Go to step 14.	\${nodeText.noSymptomCode}	
9.	<p>Turn off computer, remove bottom cover, and disconnect and remove battery. Disconnect fan cable connector and inspect logic board and fan cable connector pins for damage.</p> <p>Was there any cable or connector damage found on fan or logic board?</p>	Yes	Go to step 10.	\${nodeText.yesSymptomCode}	
		No	Go to step 11.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
10.	<p>Identify whether fan or logic board is damaged.</p> <p>Which part is damaged?</p>	Logic Board	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M24	MLB
		Fan	<p>Replace fan.</p> <p>Verify issue resolved.</p>	X22	OTHER ELECTRIC
11.	<p>Remove fan to reveal inner side of heat sink. Use an ESD-safe vacuum to remove dust or debris from inner side of heat sink fin stack. Reinstall fan and reseal fan cable connection to logic board and retest.</p> <p>Does computer pass fan motor check?</p>	Yes	Issue resolved by cleaning airflow and reseating fan cable. Verify resolution.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 12.	`\${nodeText.noSymptomCode}`	
12.	<p>To troubleshoot this issue completely, a known-good fan is required.</p> <p>Do you have immediate access to a known-good fan?</p>	Yes	Go to step 13.	`\${nodeText.yesSymptomCode}`	
		No	<p>Replace fan.</p> <p>Verify issue resolved.</p>	X22	OTHER ELECTRIC

	Check	Result	Action	Code	Commodity
13.	Substitute a known-good fan and retest. Does known-good fan pass fan motor check?	Yes	Replace fan. Verify issue resolved.	X22	OTHER ELECTRIC
		No	Replace the logic board. Reinstall user's fan. Use Blank Board Serializer (BBS) to set the computer's serial number. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	M18	MLB
14.	A disconnected, shorted, or failing sensor will lead computer to preventively operate fan(s) at higher speed. Do diagnostics report a TXxx thermal sensor failure?	Yes	Go to step 15.	\$(nodeText.yesSymptomCode)	
		No	Go to step 39.	\$(nodeText.noSymptomCode)	
15.	Remove fan to reveal inner side of heat sink. Use an ESD-safe vacuum to remove dust or debris from inner side of heat sink fin stack. Reinstall fan and reseal fan cable connection to logic board and retest. Does computer pass all diagnostics checks?	Yes	Issue resolved by cleaning airflow. Verify resolution.	\$(nodeText.yesSymptomCode)	
		No	Go to step 16.	\$(nodeText.noSymptomCode)	
16.	Determine which specific thermal sensor tests failed in MRI, and whether error codes included Ts0P . Did diagnostics report a Trackpad Thermal Sensor (Ts0P) error?	Yes	Go to step 17.	\$(nodeText.yesSymptomCode)	
		No	Go to step 24.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
17.	<p>Ts0P error indicates a problem with trackpad thermal sensor. Inspect both ends of IPD flex cable, looking for damage to cable or connector on logic board or trackpad board.</p> <p>Is there damage to connectors or flex cable that require replacement?</p>	Yes	Go to step 23.	\${nodeText.yesSymptomCode}	
		No	Go to step 18.	\${nodeText.noSymptomCode}	
18.	<p>Reseat IPD flex cable connections to trackpad and logic board, and retest.</p> <p>Is thermal sensor Ts0P still failing?</p>	Yes	Go to step 19.	\${nodeText.yesSymptomCode}	
		No	Diagnostics error fixed by reseating IPD flex cable connections. Verify issue resolved.	\${nodeText.noSymptomCode}	
19.	<p>To completely troubleshoot this issue, a known-good IPD flex cable is required.</p> <p>Do you have immediate access to a known-good IPD flex cable?</p>	Yes	Go to step 20.	\${nodeText.yesSymptomCode}	
		No	Replace user's IPD flex cable. Verify issue resolved.	X03	INTERNAL CABLE
20.	<p>Substitute a known-good IPD flex cable and retest to verify that trackpad thermal sensor is connected and operational.</p> <p>Is thermal sensor Ts0P still failing?</p>	Yes	Go to step 21.	\${nodeText.yesSymptomCode}	
		No	Replace user's IPD flex cable. Verify issue resolved.	X03	INTERNAL CABLE
21.	<p>To completely troubleshoot this issue, a known-good trackpad is required.</p> <p>Do you have immediate access to a known-good trackpad?</p>	Yes	Go to step 22.	\${nodeText.yesSymptomCode}	
		No	<p>Replace the trackpad.</p> <p>Reinstall user's IPD flex cable.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	K85	MOUSE

	Check	Result	Action	Code	Commodity
22.	<p>Substitute a known-good trackpad and retest to verify that trackpad thermal sensor Ts0P is connected and operational.</p> <p>Is trackpad thermal sensor Ts0P still failing?</p>	Yes	<p>Replace the logic board.</p> <p>Reinstall user's trackpad and IPD flex cable.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M23	MLB
		No	<p>Replace the trackpad.</p> <p>Reinstall user's IPD flex cable.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	K85	MOUSE

	Check	Result	Action	Code	Commodity
23.	<p>Determine whether damage is located on IPD flex cable, IPD board, logic board, or a combination of multiple components.</p> <p>Is damage limited to IPD flex cable only?</p>	Yes	Replace user's IPD flex cable. Verify issue resolved.	X03	INTERNAL CABLE
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	H99	
24.	<p>Check whether error codes include Battery sensor error (TB0T, TPCD), or Battery BMU 1 or BMU 2 error (TB1T, TB2T).</p> <p>Did diagnostics report any Battery Thermal Sensor (TPCD, TB0T, TB1T, or TB2T) error?</p>	Yes	Go to step 25.	\${nodeText.yesSymptomCode}	
		No	Go to step 30.	\${nodeText.noSymptomCode}	
25.	<p>TBxx error indicates a problem with a battery thermal sensor. Inspect battery connection, looking for damage to cable or connector on logic board or battery.</p> <p>Is there damage to connectors or flex cable that require replacement?</p>	Yes	Go to step 29.	\${nodeText.yesSymptomCode}	
		No	Go to step 26.	\${nodeText.noSymptomCode}	
26.	<p>Reseat battery connection and retest.</p> <p>Is thermal sensor TB0T, TB1T or TB2T still failing?</p>	Yes	Go to step 27.	\${nodeText.yesSymptomCode}	
		No	Diagnostics error fixed by reseating battery. Verify issue resolved.	\${nodeText.noSymptomCode}	
27.	<p>To completely troubleshoot this issue, a known-good battery is required.</p> <p>Do you have immediate access to a known-good battery?</p>	Yes	Go to step 28.	\${nodeText.yesSymptomCode}	
		No	Replace battery. Verify issue resolved.	P17	BATTERY

	Check	Result	Action	Code	Commodity
28.	Substitute a known-good battery and retest. Does TBxx error still occur with known-good battery?	Yes	Replace the logic board. Reinstall user's battery. Use Blank Board Serializer (BBS) to set the computer's serial number. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	M23	MLB
		No	Replace battery. Verify issue resolved.	P17	BATTERY
29.	Determine whether damage is located on battery, logic board, or a combination of multiple components. Is damage limited to battery only?	Yes	Replace battery. Verify issue resolved.	P16	BATTERY
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	P99	
30.	Determine which specific thermal sensor tests failed in MRI and whether error codes included Th1H . Did diagnostics report a Fin Stack Proximity Thermal Sensor (Th1H) error?	Yes	Go to step 31.	\${nodeText.yesSymptomCode}	
		No	Go to step 38.	\${nodeText.noSymptomCode}	
31.	Th1H error indicates a problem with heat sink proximity thermal sensor. Inspect both ends of the I/O board flex cable, looking for damage to cable or connector on logic board or I/O board. Is there damage to connectors or flex cable that require replacement?	Yes	Go to step 37.	\${nodeText.yesSymptomCode}	
		No	Go to step 32.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
32.	Reseat I/O flex cable connections to logic board and I/O board and retest. Is thermal sensor Th1H still failing?	Yes	Go to step 33.	\${nodeText.yesSymptomCode}	
		No	Diagnostics error fixed by reseating I/O flex cable connections. Verify issue resolved.	\${nodeText.noSymptomCode}	
33.	To completely troubleshoot this issue, a known-good I/O flex cable is required. Do you have immediate access to a known-good I/O flex cable?	Yes	Go to step 34.	\${nodeText.yesSymptomCode}	
		No	Replace the I/O flex cable. Verify that the issue is resolved.	X03	INTERNAL CABLE
34.	Substitute a known-good I/O flex cable and retest to verify that heat sink proximity thermal sensor is connected and operational. Is thermal sensor Th1H still failing?	Yes	Go to step 35.	\${nodeText.yesSymptomCode}	
		No	Replace the I/O flex cable. Verify that the issue is resolved.	X03	INTERNAL CABLE
35.	To completely troubleshoot this issue, a known-good I/O board is required. Do you have immediate access to a known-good I/O board?	Yes	Go to step 36.	\${nodeText.yesSymptomCode}	
		No	Replace the I/O board. Reinstall user's I/O flex cable. Verify that the issue is resolved.	M23	OTHER BOARD
36.	Substitute a known-good I/O board and reinstall user's I/O flex cable, then retest to verify that heat sink proximity thermal sensor Th1H is operational. Is thermal sensor Th1H still failing?	Yes	Go to step 39.	\${nodeText.yesSymptomCode}	
		No	Replace the I/O board. Reinstall user's I/O flex cable. Verify that the issue is resolved.	M23	OTHER BOARD
37.	Determine whether damage is located on I/O flex cable, I/O board, logic board, or a combination of multiple components. Is damage limited to I/O flex cable only?	Yes	Replace the I/O flex cable. Verify that the issue is resolved.	X03	INTERNAL CABLE
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	P99	

	Check	Result	Action	Code	Commodity
38.	<p>Determine which specific logic board thermal sensor tests failed in MRI and whether error codes included logic board thermal sensor TS2P, TC0P, TM0P, Tm0P, Ta0P, TW0P, TCHP, or THSP.</p> <p>Did MRI report a Logic Board Thermal Sensor (TS2P, TC0P, TM0P, Tm0P, Ta0P, TW0p, TCHP, THSP) error?</p>	Yes	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M23	MLB
		No	Go to step 39.	\${nodeText.noSymptomCode}	
39.	<p>Remove logic board and heat sink, wipe away existing thermal material, and apply new material. Reinstall heat sink onto logic board, tightening heat sink screws with sufficient torque. If a thermal sensor is present on heat sink, make sure it is properly reconnected to logic board. Reassemble computer and retest.</p> <p>Do diagnostics pass all checks?</p>	Yes	Issue resolved by reseating heat sink with new thermal material. Verify resolution.	\${nodeText.yesSymptomCode}	
		No	Go to step 40.	\${nodeText.noSymptomCode}	
40.	<p>To troubleshoot this issue completely, a known-good heat sink is required.</p> <p>Do you have immediate access to a known-good heat sink?</p>	Yes	Go to step 41.	\${nodeText.yesSymptomCode}	
		No	Replace heat sink and apply new thermal material. Verify issue resolved.	X10	OTHER ELECTRIC

	Check	Result	Action	Code	Commodity
41.	<p>Install a known-good heat sink with new thermal material. Reinstall heat sink onto logic board, tightening heat sink screws with sufficient torque. If a thermal sensor is present on heat sink, make sure it is properly reconnected to logic board. Reassemble computer and retest.</p> <p>Do diagnostics pass all checks?</p>	Yes	<p>Replace heat sink and apply new thermal material. Verify issue resolved.</p>	X10	OTHER ELECTRIC
		No	<p>Replace the logic board.</p> <p>Reinstall user's heat sink with new thermal material.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M18	MLB
42.	<p>Verify computer no longer overheats during use.</p> <p>Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Is the issue resolved?</p>	Yes	Issue resolved.	\${nodeText.yesSymptomCode}	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	H99	

Mechanical/Physical/Cosmetic Damage

Unlikely causes:

There are no unlikely causes for this issue.

Quick Check

Symptoms	Quick Check
<p>The computer shows signs of physical and/or cosmetic damage such as:</p> <p>Enclosure:</p> <ul style="list-style-type: none">• Hinges are loose or broken.• Screw is stripped, loose, or missing.• Liquid spill. <p>Display Assembly:</p> <ul style="list-style-type: none">• Cracked or broken display frame and/or assembly housing.• Scratches.• Dents.• Liquid spill. <p>Keyboard and Top Case:</p> <ul style="list-style-type: none">• Paint is wearing off of one or more keys on the built-in keyboard.• Scratches.• Dents.• Liquid spill. <p>AC Power Adapter:</p> <ul style="list-style-type: none">• Mechanical damage to adapter connector, cable and/or housing.• Scratches.• Dents.• Liquid spill. <p>Note: Inform the user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables.</p>	<ol style="list-style-type: none">1. Inspect the computer and discuss the nature of the issue with the user. Determine whether the user wants to proceed with the repair (despite possible accidental damage) or pursue other service options. Click “No” to proceed with further troubleshooting.2. Refer to the following articles for guidance regarding possible damage to the user’s computer, AC power adapter, or charging cable:<ul style="list-style-type: none">• TP1151: Visual/Mechanical Inspection (VMI) Guide for Mac Portables• TP1138: Visual/Mechanical Inspection (VMI) Guide for Mac Portables Display Clamshells• TP1150: Visual/Mechanical Inspection (VMI) Guide for Mac Portables Liquid Damage• TP1125: Visual/Mechanical Inspection (VMI) Guide for Mac Portables Power Adapters

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Determine the cause of damage or defects: user/technician, environment, accidental damage, or abuse.	Yes	ESCALATION REQUIRED. Contact ACS for assistance with Apple-related accidental damage.	X99	
	Is an Apple agent responsible for the damage or defect on the computer?	No	Go to step 2.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
2.	<p>Closely examine the user's computer for signs of enclosure damage, such as the following:</p> <ul style="list-style-type: none"> • Hinges are loose or broken. • Screw is stripped, loose, or missing. <p>Does the computer exhibit this type of damage?</p>	Yes	<p>Proceed with the resolution or repair using proper positioning. Inform the user that computer failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan (APP).</p> <p>Refer to www.apple.com/legal/warranty for details.</p>	X12	ENCLOSURE
		No	Go to step 3.	\$(nodeText.noSymptomCode)	
3.	<p>Closely examine the user's computer for signs of enclosure damage, such as the following:</p> <ul style="list-style-type: none"> • Scratches • Dents • Cracks <p>Does the computer exhibit this type of damage?</p>	Yes	<p>Proceed with the resolution or repair using proper positioning. Inform the user that computer failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan (APP).</p> <p>Refer to www.apple.com/legal/warranty for details.</p>	X13	ENCLOSURE
		No	Go to step 4.	\$(nodeText.noSymptomCode)	
4.	<p>Closely examine the user's computer enclosure for signs of liquid spill damage.</p> <p>Look for any signs of liquid spill, liquid penetration, or liquid damage to the computer's enclosure.</p> <p>Does the computer exhibit this type of damage?</p>	Yes	<p>Proceed with the resolution or repair using proper positioning. Inform the user that computer failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan (APP).</p> <p>Refer to www.apple.com/legal/warranty for details.</p>	X90	ENCLOSURE
		No	Go to step 5.	\$(nodeText.noSymptomCode)	
5.	<p>Closely examine the user's computer for signs of display assembly damage, such as a cracked or broken display frame and/or assembly housing.</p> <p>Note: For cracked display glass issues, return to the list of symptoms and select the “Cracked Display” troubleshooting flow.</p> <p>Does the computer exhibit this type of damage?</p>	Yes	<p>Proceed with the resolution or repair using proper positioning. Inform the user that computer failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan (APP).</p> <p>Refer to www.apple.com/legal/warranty for details.</p>	L18	LCD
		No	Go to step 6.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
6.	<p>Closely examine the user's computer display assembly for signs of cosmetic damage, such as the following:</p> <ul style="list-style-type: none"> Scratches Dents <p>Does the computer exhibit this type of damage?</p>	Yes	<p>Proceed with the resolution or repair using proper positioning. Inform the user that computer failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan (APP).</p> <p>Refer to www.apple.com/legal/warranty for details.</p>	L19	LCD
		No	Go to step 7.	\$(nodeText.noSymptomCode)	
7.	<p>Closely examine the user's computer display assembly for signs of liquid spill damage.</p> <p>Look for any signs of liquid spill, liquid penetration, or liquid damage to the computer's display assembly.</p> <p>Does the computer exhibit this type of damage?</p>	Yes	<p>Proceed with the resolution or repair using proper positioning. Inform the user that computer failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan (APP).</p> <p>Refer to www.apple.com/legal/warranty for details.</p>	L90	LCD
		No	Go to step 8.	\$(nodeText.noSymptomCode)	
8.	<p>Closely examine the user's computer keyboard and top case for signs of cosmetic damage, such as the following:</p> <ul style="list-style-type: none"> Scratches Dents <p>Does the computer exhibit this type of damage?</p>	Yes	<p>Proceed with the resolution or repair using proper positioning. Inform the user that computer failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan (APP).</p> <p>Refer to www.apple.com/legal/warranty for details.</p>	K21	KEYBOARD
		No	Go to step 9.	\$(nodeText.noSymptomCode)	
9.	<p>Closely examine the user's computer keyboard and top case for signs of cosmetic damage, such as the following:</p> <ul style="list-style-type: none"> Paint is wearing off of one or more keys on the built-in keyboard. <p>Does the computer exhibit this type of damage?</p>	Yes	<p>Proceed with the resolution or repair using proper positioning. Inform the user that computer failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan (APP).</p> <p>Refer to www.apple.com/legal/warranty for details.</p>	K35	KEYBOARD
		No	Go to step 10.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
10.	Closely examine the user's computer keyboard and top case for signs of liquid spill damage.	Yes	Proceed with the resolution or repair using proper positioning. Inform the user that computer failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan (APP). Refer to www.apple.com/legal/warranty for details.	K90	KEYBOARD
	Look for any signs of liquid spill, liquid penetration, or liquid damage to the computer's keyboard and top case.				
	Does the computer exhibit this type of damage?	No	Go to step 11.	\$(nodeText.noSymptomCode)	
11.	Closely examine the user's AC power adapter for signs of connector damage, such as the following:	Yes	Proceed with the resolution or repair using proper positioning. Inform the user that computer failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan (APP). Refer to www.apple.com/legal/warranty for details.	P15	ADAPTER
	<ul style="list-style-type: none"> • Pins stuck, broken, burnt, pushed in, or bent. 				
	Does the AC power adapter exhibit this type of damage?	No	Go to step 12.	\$(nodeText.noSymptomCode)	
12.	Closely examine the user's AC power adapter for signs of mechanical damage, such as to the following:	Yes	Proceed with the resolution or repair using proper positioning. Inform the user that computer failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan (APP). Refer to www.apple.com/legal/warranty for details.	P16	ADAPTER
	<ul style="list-style-type: none"> • Adapter connector and/or cable • Adapter housing 				
	Does the AC power adapter exhibit this type of damage?	No	Go to step 13.	\$(nodeText.noSymptomCode)	
13.	Closely examine the user's AC power adapter for signs of cosmetic damage, such as the following:	Yes	Proceed with the resolution or repair using proper positioning. Inform the user that computer failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan (APP). Refer to www.apple.com/legal/warranty for details.	P21	ADAPTER
	<ul style="list-style-type: none"> • Scratches • Dents 				
	Does the AC power adapter exhibit this type of damage?	No	Go to step 14.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
14.	<p>Closely examine the user's AC power adapter for signs of liquid spill damage.</p> <p>Look for any signs of liquid spill, liquid penetration, or liquid damage to the user's AC power adapter.</p> <p>Does the AC power adapter exhibit this type of damage?</p>	Yes	<p>Proceed with the resolution or repair using proper positioning. Inform the user that computer failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan (APP).</p> <p>Refer to www.apple.com/legal/warranty for details.</p>	P90	ADAPTER
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for assistance with Apple-related accidental damage.</p>	\$(nodeText.noSymptomCode)	

Noise / Hum / Vibration

Unlikely causes:

AirPort/Bluetooth card, battery, bottom case, display clamshell, flash storage, heat sink, I/O board, logic board, top case, trackpad

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">Computer or power adapter emits noise or vibration. <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: Determining and quoting accidental damage for Mac portables.</p>	<p>Note: Verify the issue after using the computer for a few minutes to warm it, or by following steps in HT207571: Warm a Mac for testing. Doing this may help identify intermittent issues.</p> <ol style="list-style-type: none">Work with user to reproduce issue and isolate source of noise. Differentiate whether source of noise is computer or power adapter.If power adapter is source of noise, test with a known-good adapter. (A small amount of hum or vibration is normal for power adapters.)If necessary, explain to user that some noises are normal. Refer to article HT202179: About fans and fan noise in your Apple product.If the noise or vibration seems to be coming from an attached Apple USB SuperDrive, disconnect it and verify the issue again with the user's computer alone. If you verify that the noise or vibration is coming from the Apple USB SuperDrive, exit this procedure and go to the “External USB Optical Drive Noisy” troubleshooting flow.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Shut down the computer and let it cool off fully. Check for noise, hum, or vibration during startup when computer is cold. Does issue persist during cold startup?	Yes	Go to step 2.	\$(nodeText.yesSymptomCode)	
		No	Go to step 11.	\$(nodeText.noSymptomCode)	
2.	An unreadable thermal sensor can cause a fan to run excessively. Run MRI to check thermal sensors. Does MRI report any thermal sensor failures?	Yes	Go to “Computer Runs Hot” troubleshooting flow.	\$(nodeText.yesSymptomCode)	
		No	Go to step 3.	\$(nodeText.noSymptomCode)	
3.	Excessive fan operation may also occur if the computer is unable to read the fan speed. Check MRI results for fan (motor) sensor test results. Does MRI report any fan (motor) failures?	Yes	Go to step 5.	\$(nodeText.yesSymptomCode)	
		No	Go to step 4.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
4.	Disconnect the fan and briefly retest for noise, hum, or vibration. Do not leave unit running for long as it may overheat without the fan. Has the noise been eliminated?	Yes	Replace the fan. Verify that the issue is resolved.	X23	OTHER ELECTRIC
		No	Go to step 11.	\$(nodeText.noSymptomCode)	
5.	Turn off computer, remove bottom cover, and disconnect battery. Disconnect fan flex cable connector and inspect logic board and fan cable connector pins for damage. Was there any cable or connector damage found on fan or logic board?	Yes	Go to step 6.	\$(nodeText.yesSymptomCode)	
		No	Go to step 7.	\$(nodeText.noSymptomCode)	
6.	Determine whether the damage is located on the fan flex cable, the top case, or both. Is the damage limited to the fan flex cable?	Yes	Replace the fan. Verify that the issue is resolved.	X23	OTHER ELECTRIC
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	
7.	Carefully reseal the fan flex cable into its connector on the logic board. Reassemble the computer and run diagnostics again. Do diagnostics still report the fan failure?	Yes	Go to step 8.	\$(nodeText.yesSymptomCode)	
		No	Issue resolved by reseating fan. Verify resolution.	\$(nodeText.noSymptomCode)	
8.	Remove fan to reveal inner side of heat sink. Use an ESD-safe vacuum to remove dust and debris from heat sink. Reassemble the computer and run diagnostics again. Do diagnostics still report the fan failure?	Yes	Go to step 9.	\$(nodeText.yesSymptomCode)	
		No	Issue resolved by cleaning fan. Verify resolution.	\$(nodeText.noSymptomCode)	
9.	To troubleshoot this issue completely, a known-good fan is required. Do you have immediate access to known-good fan?	Yes	Go to step 10.	\$(nodeText.yesSymptomCode)	
		No	Replace the fan. Verify that the issue is resolved.	X23	OTHER ELECTRIC

	Check	Result	Action	Code	Commodity
10.	Substitute known-good fan and retest with MRI. Does known-good fan pass the fan (motor) test in MRI?	Yes	Replace the logic board. Reinstall user's fan. Use Blank Board Serializer (BBS) to set the computer's serial number. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	M18	MLB
		No	Replace the fan. Verify that the issue is resolved.	X23	OTHER ELECTRIC
11.	Substitute a known-good power adapter and retest.	Yes	Replace power adapter. Verify that the issue is resolved.	P04	ADAPTER
	Has the noise been eliminated?	No	Go to step 12.	\$(nodeText.noSymptomCode)	
12.	Disconnect any peripheral devices, cards, or cables attached to computer. Has the noise been eliminated?	Yes	Issue resolved. Issue caused by ground loop induced by third-party devices. Advise user to connect all devices to a common power outlet or contact the device manufacturer for support.	\$(nodeText.yesSymptomCode)	
		No	Go to step 13.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
13.	<p>Noise may be related to interference from other electrical devices operating near computer or plugged into same power outlet.</p> <p>See if noise is eliminated when computer runs in a different location on a different circuit.</p> <p>Has the noise been eliminated?</p>	Yes	Issue resolved. Verify resolution.	\$(nodeText.yesSymptomCode)	
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	
14.	<p>Verify that noise, hum or vibration is resolved. Except for fan and audio circuitry, noise from the flash storage design of computer should be none.</p> <p>If help is needed, record a sample audio file to review with ACS.</p> <p>Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Is the issue resolved?</p>	Yes	Issue resolved.	\$(nodeText.yesSymptomCode)	
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	

Power Button Stuck

Unlikely causes:

Wireless card, bottom case, display clamshell, fan, flash storage, heat sink, logic board, speakers

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">• Computer will not start up.• Long tone during startup.• Computer repeatedly starts up on its own.• Computer shuts down during startup process. <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables.</p>	<ol style="list-style-type: none">1. Check whether issue occurs when computer is running on battery alone.2. If issue occurs on battery power alone, check battery health using Mac Resource Inspector (MRI).3. Reset the SMC using the procedure for this computer in article HT201295: Reset the System Management Controller (SMC) on your Mac.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	If SMC reset did not resolve the issue, perform a manual reset by disconnecting battery and power adapter for 30 seconds. Plug in power adapter and retest.	Yes	Issue resolved by resetting SMC. Verify issue resolved.	\$(nodeText.yesSymptomCode)	
	Does power button function normally?	No	Go to step 2.	\$(nodeText.noSymptomCode)	
2.	Inspect IPD flex cable for loose or damaged connections. Align and reseat flex cable to ensure a proper connection.	Yes	Issue resolved by reseating cable. Verify issue resolved.	\$(nodeText.yesSymptomCode)	
	Reconnect flex cable to logic board and retest.	No	Go to step 3.	\$(nodeText.noSymptomCode)	
3.	Remove the bottom case and disconnect the IPD flex cable from the logic board. On the logic board there are two power-on pads that can be shorted to power on a computer. Refer to article TP695: Portables: Logic Board Power-On Pads for exact location of each model's power-on pads. Note: Be extra careful not to touch any other components to avoid damaging the logic board. Did computer start up?	Yes	Replace the top case assembly. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	K19	KEYBOARD
		No	Go to "No Power" troubleshooting flow.	\$(nodeText.noSymptomCode)	
4.	Start up, shut down, and restart the computer using power button to verify repair.	Yes	Issue resolved.	\$(nodeText.yesSymptomCode)	
	Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain. Verify that the issue is resolved. Is the issue resolved?	No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	

Battery Leaking or Swollen

Unlikely causes:

Wireless card, display clamshell, fan, flash storage, heat sink, logic board, power adapter, speakers

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">Trackpad button does not work, or is stuck and will not release.Computer does not run on battery power alone.Seams in battery case are separating, exposing the cells.Computer wobbles and will not sit evenly on flat surface.Bottom case cannot be reinstalled. <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables.</p>	<ol style="list-style-type: none">Check for correct installation of bottom case. An expanded battery may be preventing complete installation of the bottom case cover.Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables to check for causes that would prevent correct installation of the bottom case or battery.Refer to article HT204762: Enclosure separation due to expanded battery.Follow the guidelines in article OP693: MacBook Air (Late 2010 and later), MacBook Pro with Retina display computers: Visual battery inspection.Follow the guidelines in article OP24: Safely handling lithium batteries and lithium battery-powered devices.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Follow service guide procedures to remove the bottom case and disconnect the battery from the logic board. Inspect the battery for any sign of battery cell puncture, leakage, venting, or cell deformation. Refer to section 5 of article OP24: Safely handling lithium batteries and lithium battery-powered devices , titled “Venting batteries” and “Response Procedures.” Recognize battery cell electrolyte leakage.	Yes	Remove any foreign material in the battery bay. Replace the battery. See article OP24: SERVICE: Safely Handling Lithium Ion and Lithium Polymer Batteries for instructions on how to dispose of a leaking battery. Verify issue resolved.	P13	BATTERY
	Apply a protective battery cover to the computer battery that is being serviced. If a battery cell is leaking: 1. Keep all personnel at a safe distance to prevent persons from coming in contact with spilled material. 2. Eliminate all ignition sources and other debris (no heat sources, sparks, or flames in immediate area). A leaking battery should only be handled by trained and properly equipped personnel. Are any battery cells punctured, leaking, or deformed?	No	Go to step 2.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
2.	Reinstall the battery. Check that the battery can be inserted correctly into the battery bay. Verify that the bottom case sits evenly. Can battery and bottom case both be installed correctly?	Yes	Go to step 5.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 3.	`\${nodeText.noSymptomCode}`	
3.	Disconnect and/or remove the battery. Inspect the battery bay for foreign material. Use compressed air to remove any dust or debris. Reinstall/reconnect the battery and verify that the battery connector can be fully seated and is correctly aligned. Make sure the bottom case can be installed correctly. Do battery and bottom case seat correctly?	Yes	Issue resolved by cleaning out the battery bay. Verify resolution.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 4.	`\${nodeText.noSymptomCode}`	
4.	Inspect the top case and the bottom cover for damage or defect (bent corner, dents, and so forth) that could explain the uneven battery seating. Do top or bottom cases show any signs of damage that would prevent correct battery seating?	Yes	Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables .	`\${nodeText.yesSymptomCode}`	
		No	Go to step 5.	`\${nodeText.noSymptomCode}`	
5.	Reinstall the battery, start up the computer, and verify that the trackpad click functions normally, not affected by an expanded or swollen battery. Does trackpad click work as expected?	Yes	Issue resolved by reseating the battery. Verify resolution.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 6.	`\${nodeText.noSymptomCode}`	
6.	Connect the power adapter, remove the battery, and verify that the trackpad click functions normally. Does trackpad click work as expected?	Yes	Go to step 7.	`\${nodeText.yesSymptomCode}`	
		No	Go to “Built-in Trackpad Does Not Track Properly” troubleshooting flow.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
7.	<p>To troubleshoot this issue completely, a known-good battery is required.</p> <p>Do you have immediate access to a known-good battery?</p>	Yes	Go to step 8.	\$(nodeText.yesSymptomCode)	
		No	<p>Replace the battery. For positioning on warranty coverage, refer to article OP13: SERVICE: Notebook Computer Battery and Adapter Screening Process.</p> <p>Verify issue resolved.</p>	P13	BATTERY
8.	<p>Substitute a known-good battery and verify that the trackpad click functions normally.</p> <p>Does trackpad click work as expected?</p>	Yes	<p>Replace the battery. For positioning on warranty coverage, refer to article OP13: SERVICE: Notebook Computer Battery and Adapter Screening Process.</p> <p>Verify issue resolved.</p>	P13	BATTERY
		No	<p>Reinstall the user's battery and perform a partless repair using the trackpad adjustment process. Verify resolution.</p>	\$(nodeText.noSymptomCode)	
9.	<p>Run Mac Resource Inspector (MRI) and verify that computer passes all tests, especially battery health. Also verify that the trackpad click functions normally.</p> <p>Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Is the issue resolved?</p>	Yes	Issue resolved.	\$(nodeText.yesSymptomCode)	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	P99	

Battery Not Recognized or Does Not Charge

Unlikely causes:

Wireless card, bottom case, display clamshell, fan, flash storage, heat sink, top case, trackpad

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">MagSafe 2 LED does not light upMagSafe 2 LED illuminates green only—no amber LED to indicate chargingX in battery status menuNo lightning icon in battery status menu when power adapter is connected <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables.</p>	<ol style="list-style-type: none">Refer to article HT201700: Find the right power adapter and cord for your Mac notebook to make sure correct power adapter (wattage and type) is being used for this computer.Refer to HT203207: Troubleshooting MagSafe adapters. Check for debris, stuck pins, or dirty MagSafe 2 connectors on both the power adapter and the power port on computer. Remove debris, clean connectors, and adjust stuck pins as necessary.Inspect the power adapter, connectors, duckhead, and charging cable for damage such as bent plug pins, frayed or exposed wiring, or burn marks.Test power adapter using AST or AST 2 Power Adapter Diagnostic.Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.Reset the SMC using the procedure for this computer in article HT201295: Reset the System Management Controller (SMC) on your Mac.Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Attach known-good power adapter to computer and check LED on power adapter's MagSafe 2 connector. Does LED light up and stay green, or is LED off?	LED Stays Green	Go to step 2.	\$(nodeText.yesSymptomCode)	
		LED Is Off	Go to the "Power Adapter Issues" troubleshooting flow.	\$(nodeText.noSymptomCode)	
2.	Start up computer and check to see whether battery status menu icon shows an X, indicating that installed battery is not recognized. Does battery menu icon show an X?	Yes	Go to step 3.	\$(nodeText.yesSymptomCode)	
		No	Go to step 8.	\$(nodeText.noSymptomCode)	
3.	Press Option key while clicking on battery menu icon. Check to see whether menu shows "Your battery needs service" or "Service Battery." Does menu indicate that battery needs service?	Yes	Go to step 8.	\$(nodeText.yesSymptomCode)	
		No	Go to step 4.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
4.	Continue to use known-good power adapter. Reseat battery power cable to logic board. Verify battery is recognized and charging. Does computer run from and charge user's battery?	Yes	Issue resolved by reseating battery cable. Verify resolution.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 5.	`\${nodeText.noSymptomCode}`	
5.	To troubleshoot this issue completely, the following known-good parts are required. <ul style="list-style-type: none">BatteryI/O board Do you have immediate access to each of these known-good parts?	Yes	Go to step 6.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 8.	`\${nodeText.noSymptomCode}`	
6.	Substitute known-good battery. Verify battery is recognized and charging. Does computer run from and charge a known-good battery?	Yes	Go to step 8.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 7.	`\${nodeText.noSymptomCode}`	
7.	Substitute known-good I/O board. Verify battery is recognized and charging. Does computer run from and charge a known-good I/O board?	Yes	Replace the I/O board. Reinstall user's battery. Verify that the issue is resolved.	M20	OTHER BOARD
		No	Replace the logic board. Reinstall user's battery Use Blank Board Serializer (BBS) to set the computer's serial number. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	M20	MLB
8.	With user's battery installed, run Mac Resource Inspector (MRI) to verify battery health. Check whether MRI reports battery status as Good . Does MRI report battery health as Good?	Yes	Battery is within specification. It should continue to function until consumed. Recommend user consult www.apple.com/batteries .	`\${nodeText.yesSymptomCode}`	
		No	Go to step 9.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
9.	Specify whether negative result for battery status is Consumed (Depleted) or Defective (Bad).	Consumed	Replace the battery. Verify that the issue is resolved.	P18	BATTERY
	Which battery status does MRI report: Consumed or Defective?	Defective	Go to step 10.	\${nodeText.noSymptomCode}	
10.	If battery health is reported as Defective (Bad), check to see whether battery is still covered by Apple's one-year limited warranty or AppleCare Protection Plan.	In warranty	Go to step 11.	\${nodeText.yesSymptomCode}	
	Is battery IN or OUT of warranty?	Out of warranty	Replace the battery. Verify that the issue is resolved.	P18	BATTERY
11.	<ul style="list-style-type: none"> • Battery Runtime Too Short • Battery Will Not Charge • Battery Not Recognized • Battery Will Not Run 	Yes	Replace the battery. Verify that the issue is resolved.	P09	BATTERY
	Does this symptom best define the battery issue?	No	Go to step 12.	\${nodeText.noSymptomCode}	
12.	<ul style="list-style-type: none"> • Battery Runtime Too Short • Battery Will Not Charge • Battery Not Recognized • Battery Will Not Run 	Yes	Replace the battery. Verify that the issue is resolved.	P10	BATTERY
	Does this symptom best define the battery issue?	No	Go to step 13.	\${nodeText.noSymptomCode}	
13.	<ul style="list-style-type: none"> • Battery Runtime Too Short • Battery Will Not Charge • Battery Not Recognized • Battery Will Not Run 	Yes	Replace the battery. Verify that the issue is resolved.	P11	BATTERY
	Does this symptom best define the battery issue?	No	Go to step 14.	\${nodeText.noSymptomCode}	
14.	<ul style="list-style-type: none"> • Battery Runtime Too Short • Battery Will Not Charge • Battery Not Recognized • Battery Will Not Run 	Yes	Replace the battery. Verify that the issue is resolved.	P12	BATTERY
	Does this symptom best define the battery issue?	No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	P99	

	Check	Result	Action	Code	Commodity
15.	Connect power adapter and verify MagSafe 2 connector LED lights up amber. Charge battery for some time. Then run computer from battery for only a few minutes. Reconnect power adapter and verify computer correctly detects adapter and charges battery.	Yes	Issue resolved.	`\${nodeText.yesSymptomCode}`	
	<p>Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Is the issue resolved?</p>	No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	P99	

Battery Runtime Too Short

Unlikely causes:

Wireless card, bottom case, display clamshell, fan, flash storage, heat sink, logic board, top case, trackpad

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">Battery runs out of power very quickly (in less than two hours).Battery runs out of power without any warning.Battery menu says Service Battery, Replace Now, or Replace Soon. <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables.</p>	<ol style="list-style-type: none">Refer to article HT201700: Find the right power adapter and cord for your Mac notebook to make sure correct power adapter (wattage and type) is being used for this computer.Verify that applications are not forcing CPU or GPU to work overtime and consume unnecessary battery power. Refer to article HT203184: See how apps affect Mac performance, battery runtime, temperature, and fan activity. To help extend battery performance, refer the user to article HT204054: About Mac notebook batteries.Refer to HT203207: Troubleshooting MagSafe adapters. Check for debris, stuck pins, or dirty MagSafe 2 connectors on both the power adapter and the power port on computer. Remove debris, clean connectors, and adjust stuck pins as necessary.Inspect the power adapter, connectors, duckhead, and charging cable for damage such as bent plug pins, frayed or exposed wiring, or burn marks.Run AST or AST 2 Power Adapter diagnostics with the user's power adapter connected to a known-good computer, to confirm that the power adapter is functioning.Run AST or AST 2 Power Adapter diagnostics with a known-good power adapter connected to the user's computer to confirm that the computer is functioning.Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.Reset the SMC using the procedure for this computer in article HT201295: Reset the System Management Controller (SMC) on your Mac.Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	While connected to the user's power adapter and charging cable, run MRI via AST or AST 2 to gather diagnostic information about the battery. Check the results for any battery-specific warnings or failures. Does MRI report any battery errors?	Yes	Go to step 3.	\$(nodeText.yesSymptomCode}	
		No	Go to step 2.	\$(nodeText.noSymptomCode}	
2.	Run Power Adapter diagnostics. Power Adapter diagnostics may report a faulty power adapter, which could cause short battery runtimes. Did Power Adapter diagnostics report a power adapter failure?	Yes	Go to the "Power Adapter Issues" troubleshooting flow.	\$(nodeText.yesSymptomCode}	
		No	There is no hardware issue with the battery or power adapter. Proceed with software troubleshooting. Recommend that the user refer to www.apple.com/batteries for tips to maximize battery life.	\$(nodeText.noSymptomCode}	
3.	Specify whether negative result for battery status is Consumed (Depleted) or Defective (Bad). Which battery status does MRI report: Consumed or Defective?	Consumed	The battery is nearly or fully consumed. Advise user that consumed batteries are not covered under Apple warranty. Replace the battery if user approves out-of-warranty costs. Verify that the issue is resolved.	P18	BATTERY
		Defective	Go to step 4.	\$(nodeText.noSymptomCode}	
4.	If battery health is reported as Defective (Bad), check to see whether battery is still covered by Apple's one-year limited warranty or AppleCare Protection Plan. Is battery IN or OUT of warranty?	In warranty	Replace the battery. Verify that the issue is resolved.	P09	BATTERY
		Out of warranty	Replace the battery out of warranty. Verify that the issue is resolved.	P18	BATTERY
5.	Verify that battery runtime falls within specification. Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain. Verify that the issue is resolved. Is the issue resolved?	Yes	The issue is resolved.	\$(nodeText.yesSymptomCode}	
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	

Does Not Run on Power Adapter

Unlikely causes:

Wireless card, bottom case, display clamshell, fan, flash storage, heat sink, speakers, top case, trackpad

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">Computer runs on battery, but not on power adapter alone. <p>Note: Inform the user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables.</p>	<ol style="list-style-type: none">Verify that you are using a functional power outlet.Refer to article HT201700: Find the right power adapter and cord for your Mac notebook to make sure correct power adapter (wattage and type) is being used for this computer.Refer to HT203207: Troubleshooting MagSafe adapters. Check for debris, stuck pins, or dirty MagSafe 2 connectors on both the power adapter and the power port on computer. Remove debris, clean connectors, and adjust stuck pins as necessary.Inspect the power adapter, connectors, duckhead, and charging cable for damage such as bent plug pins, frayed or exposed wiring, or burn marks.Run AST or AST 2 Power Adapter diagnostics with the user's power adapter connected to a known-good computer, to confirm that the power adapter is functioning.Run AST or AST 2 Power Adapter diagnostics with a known-good power adapter connected to the user's computer to confirm that the computer is functioning.Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.Reset the SMC using the procedure for this computer in article HT201295: Reset the System Management Controller (SMC) on your Mac.Refer to HT204319: macOS versions and builds included with Mac computers to make sure system build is correct for this computer model. Check for and apply the latest software and firmware updates.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Inspect the MagSafe 2 receptacle for any signs of deformation, damage, or debris that may be blocking the connection. Use compressed air to clear any obstructions or debris.	Yes	Go to step 2.	<code>\$(nodeText.yesSymptomCode)</code>	
	Important: Do not use any metal objects to clear debris or obstructions, as this can short the connector and cause damage.	No	Go to step 3.	<code>\$(nodeText.noSymptomCode)</code>	
	Is the MagSafe 2 port damaged?				

	Check	Result	Action	Code	Commodity
2.	<p>Inspect the opening on the top case for the MagSafe 2 receptacle. Determine whether the opening is misshapen or deformed, preventing proper insertion of the MagSafe connector.</p> <p>Is the opening for the MagSafe 2 port damaged or deformed?</p>	Yes	<p>Replace the top case assembly.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	K16	KEYBOARD
		No	<p>Replace the I/O board.</p> <p>Verify that the issue is resolved.</p>	M24	OTHER BOARD
3.	<p>Attach known-good power adapter to computer and check LED on power adapter's MagSafe 2 connector.</p> <p>Verify that the MagSafe 2 connector LED turns on either green or amber.</p> <p>Does LED turn ON either green or amber?</p>	Yes	Go to step 13.	\${nodeText.yesSymptomCode}	
		No	Go to step 4.	\${nodeText.noSymptomCode}	
4.	<p>Remove the bottom case and disconnect battery. Disconnect the input/output (I/O) flex cable from the logic board and the I/O board.</p> <p>Inspect the cable and connectors for damage. Look for pinching or crimping, and damaged or bent pins.</p> <p>Does the I/O flex cable show signs of damage?</p>	Yes	Go to step 5.	\${nodeText.yesSymptomCode}	
		No	Go to step 6.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
5.	<p>Inspect the logic board and I/O board I/O connectors for damage.</p> <p>Is the connector on the logic board or I/O board also damaged?</p>	Yes	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	
		No	<p>Replace the I/O flex cable.</p> <p>Verify that the issue is resolved.</p>	X03	INTERNAL CABLE
6.	<p>While the I/O flex cable is removed, disconnect the I/O power cable from the logic board.</p> <p>Inspect the cable and connector for damage. Look for pinching or crimping, and damaged or bent pins.</p> <p>Does the I/O power cable show signs of damage?</p>	Yes	<p>Replace the I/O board.</p> <p>Verify that the issue is resolved.</p>	M24	OTHER BOARD
		No	Go to step 7.	\${nodeText.noSymptomCode}	
7.	<p>Inspect the logic board I/O flex cable and power cable connectors for damage.</p> <p>Does either connector on the logic board show signs of damage?</p>	Yes	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M24	MLB
		No	Go to step 8.	\${nodeText.noSymptomCode}	
8.	<p>Inspect the I/O board I/O flex cable connector for damage.</p> <p>Does the connector on the I/O board show signs of damage?</p>	Yes	<p>Replace the I/O board.</p> <p>Verify that the issue is resolved.</p>	M24	OTHER BOARD
		No	Go to step 9.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
9.	Reseat the I/O board flex cable and power cable connections to the logic board and I/O board.	Yes	Go to step 13.	\${nodeText.yesSymptomCode}	
	<p>Attach a known-good power adapter to computer and check LED on power adapter's MagSafe 2 connector.</p> <p>Verify that the MagSafe 2 connector LED lights up green or amber.</p> <p>Does LED turn ON either green or amber?</p>	No	Go to step 10.	\${nodeText.noSymptomCode}	
10.	To completely troubleshoot this issue, the following known-good parts are required.	Yes	Go to step 11.	\${nodeText.yesSymptomCode}	
	<ul style="list-style-type: none"> I/O flex cable I/O board <p>Do you have immediate access to each of these known-good parts?</p>	No	<p>Replace the I/O flex cable.</p> <p>Verify that the issue is resolved.</p>	X03	INTERNAL CABLE
11.	Substitute a known-good I/O flex cable.	Yes	Replace the I/O flex cable.	X03	INTERNAL CABLE
	<p>Attach a known-good power adapter to computer and check LED on power adapter's MagSafe 2 connector.</p> <p>Verify that the MagSafe 2 connector LED lights up green or amber.</p> <p>Does LED turn ON either green or amber?</p>		Verify that the issue is resolved.		
		No	Go to step 12.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
12.	<p>Substitute a known-good I/O board.</p> <p>Attach a known-good power adapter to computer and check LED on power adapter's MagSafe 2 connector.</p> <p>Verify that the MagSafe 2 connector LED lights up green or amber.</p> <p>Does LED turn ON either green or amber?</p>	Yes	<p>Replace the I/O board.</p> <p>Reinstall user's I/O flex cable.</p> <p>Verify that the issue is resolved.</p>	M21	OTHER BOARD
		No	<p>Replace the logic board.</p> <p>Reinstall user's I/O flex cable and I/O board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M21	MLB
13.	<p>Continue to use the known-good power adapter. Verify that the computer starts up and stays on.</p> <p>Does computer start up and stay on?</p>	Yes	Go to step 14.	`\${nodeText.yesSymptomCode}`	
		No	Go to "Will Not Start Up" troubleshooting flow.	`\${nodeText.noSymptomCode}`	
14.	<p>Disconnect the battery, connect a known-good power adapter, and verify that the computer starts up and stays on.</p> <p>Does computer start up and stay on with battery removed?</p>	Yes	Go to step 15.	`\${nodeText.yesSymptomCode}`	
		No	<p>Replace the I/O board.</p> <p>Verify that the issue is resolved.</p>	M21	OTHER BOARD
15.	<p>With the battery still disconnected, connect the user's power adapter and verify that the computer starts up and stays on.</p> <p>Does computer start up and stay on with user's power adapter?</p>	Yes	Go to step 16.	`\${nodeText.yesSymptomCode}`	
		No	<p>Replace the power adapter.</p> <p>Verify that the issue is resolved.</p>	P23	ADAPTER

	Check	Result	Action	Code	Commodity
16.	Discharge the user's battery to below 50 percent. Verify that the user's power adapter will support computer operation (start up and stay on) while charging the user's battery. Does computer start up, stay on, and continue to charge battery?	Yes	Issue cannot be duplicated.	#{nodeText.yesSymptomCode}	
		No	Go to step 17.	#{nodeText.noSymptomCode}	
17.	Substitute a known-good power adapter and verify that it will support computer operation (start up and stay on) while charging the user's battery. Does computer start up, stay on, and continue to charge battery?	Yes	Replace the power adapter. Verify that the issue is resolved.	P23	ADAPTER
		No	Go to step 18.	#{nodeText.noSymptomCode}	
18.	To troubleshoot this issue completely, a known-good battery is required. Do you have immediate access to a known-good battery?	Yes	Go to step 19.	#{nodeText.yesSymptomCode}	
		No	Replace the battery. Verify that the issue is resolved.	P12	BATTERY
19.	Discharge a known-good battery below 50 percent. Verify that the user's power adapter will support computer operation (start up and stay on) while charging the known-good battery. Does computer start up, stay on, and continue to charge battery?	Yes	Replace the battery. Verify that the issue is resolved.	P12	BATTERY
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	P99	
20.	Verify that the computer will start up and stay on when powered by the battery alone and then the power adapter alone. Confirm that the power adapter will simultaneously support computer operation and battery charging. Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain. Verify that the issue is resolved. Is the issue resolved?	Yes	Issue resolved.	#{nodeText.yesSymptomCode}	
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	P99	

Intermittent Shutdown

Unlikely causes:

Wireless card, bottom case, display clamshell, speakers, top case

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">Shuts down during startupShuts down unexpectedly during use <p>Note: Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables.</p>	<ol style="list-style-type: none">Collect the following details from the user regarding shutdown occurrence and system configuration: when shutdown occurs (for example, on battery power or after running for a while), the frequency of shutdowns, which applications are running at the time, and shutdown repeatability.Verify the battery charge and battery connection status.Unplug power adapter from computer then plug power adapter back into computer.Refer to HT203207: Troubleshooting MagSafe adapters. Check for debris, stuck pins, or dirty MagSafe 2 connectors on both the power adapter and the power port on computer. Remove debris, clean connectors, and adjust stuck pins as necessary.Inspect the power adapter, connectors, duckhead, and charging cable for damage such as bent plug pins, frayed or exposed wiring, or burn marks.Hold the Shift key down during startup to put the computer into safe mode. Refer to article HT201262: Use safe mode to isolate issues with your Mac.Start up the computer using known-good original system media or an up-to-date, bootable macOS volume.Run Mac Resource Inspector (MRI) to check fan (motor) and thermal sensor detection and values.Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.Reset the SMC using the procedure listed for this computer in article HT201295: Reset the System Management Controller (SMC) on your Mac.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Power and thermal issues can cause intermittent shutdowns. Run Mac Resource Inspector (MRI) via AST or AST 2 to check for problems detected by sensors. Does MRI report any sensor errors?	Yes	Go to step 2.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 6.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
2.	Identify specific type of failure reported in MRI: Thermal/fan sensor or voltage/current sensor.	Thermal/Fan Sensor	Go to the “Computer Runs Hot” troubleshooting flow.	\$(nodeText.yesSymptomCode)	
	There are three types of sensors that are used in the computer: voltage, current, and temperature. The sensor type is identified by the first letter in the sensor key.				
	<ul style="list-style-type: none"> Voltage sensor keys start with “V” Current sensor keys start with “I” Temperature sensor keys start with “T” <p>Which sensor failure does MRI report?</p>	Voltage/Current Sensor	Go to step 3.	\$(nodeText.noSymptomCode)	
3.		Yes	Go to step 4.	\$(nodeText.yesSymptomCode)	
	To troubleshoot this issue completely, the following known-good parts are required.		Replace the logic board.		
	<ul style="list-style-type: none"> Battery I/O board <p>Do you have immediate access to each of these known-good parts?</p>	No	<p>Use Blank Board Serializer (BBS) to set the computer’s serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M08	MLB
4.	Substitute known-good battery and retest. Try to replicate the shutdown issue.	Yes	<p>Replace the battery.</p> <p>Verify that the issue is resolved.</p>	P02	BATTERY
	Does the intermittent shutdown issue persist?	No	Go to step 5.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
5.	Substitute known-good I/O board and retest. Try to replicate the shutdown issue. Does the intermittent shutdown issue persist?	Yes	Replace the logic board. Reinstall user's battery and I/O board. Use Blank Board Serializer (BBS) to set the computer's serial number. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	M08	MLB
		No	Replace the I/O board. Reinstall user's battery. Verify that the issue is resolved.	M08	OTHER BOARD
6.	Run MRI and Power Adapter diagnostics.	Yes	Go to step 7.	\${nodeText.yesSymptomCode}	
	MRI may report a consumed or defective battery, and or Power Adapter diagnostics may report a faulty power adapter. Either issue can cause intermittent shutdowns. Did MRI or Power Adapter diagnostics report a battery or power adapter failure?	No	Go to step 8.	\${nodeText.noSymptomCode}	
7.	Specify whether MRI or Power Adapter diagnostics reported a battery error or a power adapter error.	Battery	Go to "Battery Not Recognized or Does Not Charge" troubleshooting flow.	\${nodeText.yesSymptomCode}	
	Which component failure is reported?	Power Adapter	Go to "Does Not Run on Power Adapter" troubleshooting flow.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
8.	Run Cooling System Diagnostic (CSD) and check whether the computer unexpectedly shuts down. Is the shutdown event reproducible?	Yes	Go to step 11.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 9.	`\${nodeText.noSymptomCode}`	
9.	Check the results for Cooling System Diagnostic via the AST 2 console to see if any failures were recorded. Are any failures reported by CSD?	Yes	Go to the “Computer Runs Hot” troubleshooting flow.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 10.	`\${nodeText.noSymptomCode}`	
10.	Run Full System Diagnostic (both EFI and OS) and check whether the computer unexpectedly shuts down. Is the shutdown event reproducible?	Yes	Go to step 11.	`\${nodeText.yesSymptomCode}`	
		No	No failure was found during testing. Using correct positioning, return the computer to the user with no trouble found.	`\${nodeText.noSymptomCode}`	
11.	To completely troubleshoot this issue, a known-good logic board is required. Do you have immediate access to a known-good logic board?	Yes	Go to step 12.	`\${nodeText.yesSymptomCode}`	
		No	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer’s serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M08	MLB

	Check	Result	Action	Code	Commodity
12.	Substitute a known-good logic board and retest. Try to replicate the shutdown issue. Does the intermittent shutdown issue persist?	Yes	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	
		No	Replace the logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	M08	MLB
13.	Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain. Verify that the issue is resolved. Is the issue resolved?	Yes	The issue is resolved.	\${nodeText.yesSymptomCode}	
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	

Kernel Panic / System Crashes

Unlikely causes:

Wireless card, bottom case, power adapter, speakers, top case, trackpad

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">Computer restarts and displays a kernel panic alert message. Refer to article HT200553: When your computer spontaneously restarts or displays “Your computer restarted because of a problem.”Computer freezes during use.Computer freezes upon wake from sleep.Computer freezes when Wi-Fi is turned on or activated. <p>Note: Inform the user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables.</p>	<ol style="list-style-type: none">Collect the following details from the user regarding kernel panic or crash occurrence and system configuration: when issue occurs (for example, on battery power or after running for a while), the frequency of crashes, which applications are running at the time, and repeatability.Check for and apply the latest software and firmware updates.Disconnect any external peripherals.Hold the Shift key down during startup to put the computer into safe mode. Refer to article HT201262: Use safe mode to isolate issues with your Mac.Start up from Recovery Partition, Internet Recovery, or an up-to-date, bootable macOS volume. Refer to article HT204319: macOS versions and builds included with Mac computers.Follow troubleshooting in article HT200553: OS X: When your computer spontaneously restarts or displays “Your computer restarted because of a problem.”If the issue cannot be easily reproduced, Run ASD or AST 2 extended memory tests, if available, repeatedly to verify that the computer does not encounter a crash or kernel panic.Verify computer’s internal SSD card or flash storage is an Apple-installed part. Check this in MRI or compare hard drive information in System Information to article SM155: Hard Drives Matrix to determine if user’s installed drive is one of the OEM drives available for this computer configuration. Third-party flash storage without correct firmware or outside this product’s specifications may cause computer to exhibit service-related symptoms. In such cases, inform user that computer has been modified from its original, supported configuration, and that such a repair would not be covered under Apple warranty.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Bad memory or a voltage, current, or thermal sensor error can cause kernel panics or system crashes. Run Mac Resource Inspector (MRI) or consult MRI logs to check for any sensor or memory errors.	Yes	Go to step 2.	<code>\$(nodeText.yesSymptomCode)</code>	
		No	Go to step 7.	<code>\$(nodeText.noSymptomCode)</code>	
	Does MRI report any sensor or memory errors?				

	Check	Result	Action	Code	Commodity
2.	Identify the specific type of error reported in MRI: a sensor error or a memory (RAM) error. Which error does MRI report: sensor or memory?	Sensor	Go to step 3.	`\${nodeText.yesSymptomCode}`	
		Memory	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M06	MLB
3.	Identify specific type of failure reported in MRI: Thermal/fan sensor or voltage/current sensor. There are three types of sensors that are used in the computer: voltage, current, and temperature. The sensor type is identified by the first letter in the sensor key. <ul style="list-style-type: none"> Voltage sensor keys start with "V" Current sensor keys start with "I" Temperature sensor keys start with "T" Which sensor failure does MRI report?	Voltage/Current Sensor	Go to step 4.	`\${nodeText.yesSymptomCode}`	
		Thermal/Fan Sensor	Go to the "Computer Runs Hot" troubleshooting flow.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
4.	<p>To troubleshoot this issue completely, the following known-good parts are required.</p> <ul style="list-style-type: none"> Battery I/O board <p>Do you have immediate access to each of these known-good parts?</p>	Yes	Go to step 5.	`\${nodeText.yesSymptomCode}`	
		No	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M06	MLB
5.	Substitute known-good battery and retest. Try to replicate the kernel panic issue.	Yes	<p>Replace the battery.</p> <p>Verify that the issue is resolved.</p>	P02	BATTERY
	Does the kernel panic or crash still occur?	No	Go to step 6.	`\${nodeText.noSymptomCode}`	

	Check	Result	Action	Code	Commodity
6.	<p>Substitute known-good I/O board and retest. Try to replicate the kernel panic issue.</p> <p>Does the kernel panic or crash still occur?</p>	Yes	<p>Replace the logic board.</p> <p>Reinstall user's battery and I/O board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M06	MLB
		No	<p>Replace the I/O board.</p> <p>Reinstall user's battery.</p> <p>Verify that the issue is resolved.</p>	M06	OTHER BOARD
7.	<p>Reset the SMC using the procedure for this computer in article HT201295: Reset the System Management Controller (SMC) on your Mac.</p> <p>Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.</p> <p>Does the computer start up and run without a kernel panic or freeze?</p>	Yes	Issue resolved by resetting the SMC and NVRAM. Verify resolution.	\$(nodeText.yesSymptomCode)	
		No	Go to step 8.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
8.	<p>Start up the computer using Internet Recovery or an up-to-date, bootable macOS volume. Refer to article HT204319: macOS versions and builds included with Mac computers to check that the system build is correct for this computer model.</p> <p>Does the kernel panic or crash still occur?</p>	Yes	Go to step 9.	`\${nodeText.yesSymptomCode}`	
		No	<p>Reinstall macOS on the user's computer. Refer to HT204319: macOS versions and builds included with Mac computers to check that the system build is correct for this computer model. Check for and apply the latest software and firmware updates. Verify resolution.</p>	`\${nodeText.noSymptomCode}`	
9.	<p>Remove the wireless card from its logic board socket and retest. Try to replicate the kernel panic issue.</p> <p>Does the kernel panic or crash still occur?</p>	Yes	Go to step 12.	`\${nodeText.yesSymptomCode}`	
		No	Go to step 10.	`\${nodeText.noSymptomCode}`	
10.	<p>To troubleshoot this issue completely, a known-good wireless card is required.</p> <p>Do you have immediate access to a known-good wireless card?</p>	Yes	Go to step 11.	`\${nodeText.yesSymptomCode}`	
		No	<p>Replace the wireless card.</p> <p>Verify that the issue is resolved.</p>	N13	WIRELESS DEVICE

	Check	Result	Action	Code	Commodity
11.	Substitute a known-good wireless card and retest. Does kernel panic or crash still occur?	Yes	Replace the logic board. Reinstall user's wireless card. Use Blank Board Serializer (BBS) to set the computer's serial number. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	M06	MLB
		No	Replace the wireless card. Verify that the issue is resolved.	N13	WIRELESS DEVICE
12.	Memory is built onto the logic board, therefore it is not exchangeable for testing with known-good memory. Use the memory diagnostic via ASD or AST 2 to run extended memory tests. Does the memory fail testing?	Yes	Replace the logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	M06	MLB
		No	Go to step 13.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
13.	<p>Shut down the computer, remove the bottom case and disconnect battery.</p> <p>Disconnect the eDP (Embedded DisplayPort) flex cable connector from the logic board.</p> <p>Connect an external display via a Thunderbolt video adapter. Start up the computer and retest. Try to replicate the kernel panic issue.</p> <p>Does the kernel panic or crash still occur?</p>	Yes	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M06	MLB
		No	Go to step 14.		
14.	<p>Inspect the eDP flex cable for damage. Look for pinching or crimping, and damaged or bent pins.</p> <p>Does the eDP flex cable show signs of damage?</p>	Yes	Go to step 15.	{nodeText.noSymptomCode}	{nodeText.yesSymptomCode}
		No	Go to step 16.		
15.	<p>Inspect the logic board display connector for damage, paying attention to both the conductors and the locking bar.</p> <p>Is the connector on the logic board also damaged?</p>	Yes	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	
		No	<p>Replace the display clamshell.</p> <p>Verify that the issue is resolved.</p>		
				L14	LCD

	Check	Result	Action	Code	Commodity
16.	<p>Inspect the logic board display connector for damage, paying attention to both the conductors and the locking bar.</p> <p>Does the connector on the logic board show signs of damage?</p>	Yes	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M24	MLB
		No	Go to step 17.	\$(nodeText.noSymptomCode)	
17.	<p>To continue troubleshooting this issue, a known-good display clamshell is required.</p> <p>Do you have immediate access to a known-good display clamshell?</p>	Yes	Go to step 18.	\$(nodeText.yesSymptomCode)	
		No	<p>Replace the display clamshell.</p> <p>Verify that the issue is resolved.</p>	L37	LCD

	Check	Result	Action	Code	Commodity
18.	<p>Substitute a known-good display assembly and retest. Try to replicate the kernel panic issue.</p> <p>Does the kernel panic or crash still occur?</p>	Yes	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M06	MLB
		No	<p>Replace the display clamshell.</p> <p>Verify that the issue is resolved.</p>	L37	LCD
19.	<p>Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.</p> <p>Verify that the issue is resolved.</p> <p>Is the issue resolved?</p>	Yes	The issue is resolved. Verify resolution.	\${nodeText.yesSymptomCode}	
		No	<p>ESCALATION REQUIRED.</p> <p>Contact ACS for additional support or a multiple-part repair.</p>	X99	

No Power

Unlikely causes:

Bottom case, fan, heat sink, speakers

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">Computer does not turn onNo image on display and no Caps Lock light when key is pressed <p>Note: Inform the user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: Determining and quoting accidental damage for Mac portables.</p>	<ol style="list-style-type: none">Verify that you are using a functional power outlet.Refer to article HT201700: Find the right power adapter and cord for your Mac notebook to make sure correct power adapter (wattage and type) is being used for this computer.Refer to HT203207: Troubleshooting MagSafe adapters. Check for debris, stuck pins, or dirty MagSafe 2 connectors on both the power adapter and the power port on computer. Remove debris, clean connectors, and adjust stuck pins as necessary.Inspect the power adapter, connectors, duckhead, and charging cable for damage such as bent plug pins, frayed or exposed wiring, or burn marks.Disconnect all peripherals.Determine whether the computer has power by confirming that any of the following function correctly:<ul style="list-style-type: none">Keyboard Caps Lock LED illuminatesFan spin noiseDisplay activity functionsKeyboard backlight turns on with ambient light change or when the sensor is covered upAn external display functionsReset the SMC using the procedure for this computer in article HT201295: Reset the System Management Controller (SMC) on your Mac.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Inspect the MagSafe 2 receptacle for any signs of deformation, damage, or debris that may be blocking the connection. Use compressed air to clear any obstructions or debris.	Yes	Go to step 2.	\$(nodeText.yesSymptomCode)	
	Important: Do not use any metal objects to clear debris or obstructions, as this can short the connector and cause damage. Is the MagSafe 2 port damaged?	No	Go to step 3.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
2.	Inspect the opening on the top case for the MagSafe 2 receptacle. Determine whether the opening is misshapen or deformed, preventing proper insertion of the MagSafe connector.	Yes	Replace the top case assembly. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	K16	KEYBOARD
	Is the opening for the MagSafe 2 port damaged or deformed?	No	Replace the I/O board. Verify that the issue is resolved.	M24	OTHER BOARD
3.	Inspect the user's power adapter and duckhead for damage.	Yes	Go to the "Mechanical/Physical/Cosmetic Damage" troubleshooting flow.	`\${nodeText.yesSymptomCode}`	
	Check the MagSafe 2 connector on the user's power adapter and computer for contamination, debris, or damaged pins.	No	Go to step 4.	`\${nodeText.noSymptomCode}`	
4.	Does the user's power adapter or duckhead appear damaged?				
	Attach user's power adapter to computer and check LED on power adapter's MagSafe 2 connector.	Yes	Go to step 16.	`\${nodeText.yesSymptomCode}`	
	Verify that the MagSafe 2 connector LED turns on either green or amber.	No	Go to step 5.	`\${nodeText.noSymptomCode}`	
5.	Does LED turn ON either green or amber?				
	Substitute the user's duckhead / power cord for a known-good duckhead or power cord.	Yes	Replace the power cord / duckhead. Verify that the issue is resolved.	X03	EXTERNAL CABLE
	Attach user's power adapter to computer and check LED on power adapter's MagSafe 2 connector.				
	Verify that the MagSafe 2 connector LED turns on either green or amber.	No	Go to step 6.	`\${nodeText.noSymptomCode}`	
	Does LED turn ON either green or amber?				

	Check	Result	Action	Code	Commodity
6.	Substitute a known-good, compatible power adapter.	Yes	Replace the power adapter. Verify that the issue is resolved.	P23	ADAPTER
	Attach known-good power adapter to computer and check LED on power adapter's MagSafe 2 connector. Verify that the MagSafe 2 connector LED turns on either green or amber. Does LED turn ON either green or amber?	No	Go to step 7.	\$(nodeText.noSymptomCode)	
7.	Remove the bottom case and disconnect battery. Disconnect the input/output (I/O) flex cable from the logic board and the I/O board .	Yes	Go to step 8.	\$(nodeText.yesSymptomCode)	
	Inspect the cable and connectors for damage. Look for pinching or crimping, and damaged or bent pins. Does the I/O flex cable show signs of damage?	No	Go to step 9.	\$(nodeText.noSymptomCode)	
8.	Inspect the logic board and I/O board, I/O connectors for damage.	Yes	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	
	Is the connector on the logic board or I/O board also damaged?	No	Replace the I/O flex cable. Verify that the issue is resolved.	X03	INTERNAL CABLE
9.	While the I/O flex cable is removed, disconnect the I/O power cable from the logic board.	Yes	Replace the I/O board. Verify that the issue is resolved.	M24	OTHER BOARD
	Inspect the cable and connector for damage. Look for pinching or crimping, and damaged or bent pins. Does the I/O power cable show signs of damage?	No	Go to step 10.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
10.	Inspect the logic board I/O flex cable and power cable connectors for damage. Does either connector on the logic board show signs of damage?	Yes	Replace the logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	M24	MLB
		No	Go to step 11.	\$(nodeText.noSymptomCode)	
11.	Inspect the I/O board I/O flex cable connector for damage. Does the connector on the I/O board show signs of damage?	Yes	Replace the I/O board. Verify that the issue is resolved.	M24	OTHER BOARD
		No	Go to step 12.	\$(nodeText.noSymptomCode)	
12.	Reseat the I/O board flex cable and power cable connections to the logic board and I/O board. Attach a known-good power adapter to computer and check LED on power adapter's MagSafe 2 connector. Verify that the MagSafe 2 connector LED lights up green or amber. Does LED turn ON either green or amber?	Yes	Go to step 16.	\$(nodeText.yesSymptomCode)	
		No	Go to step 13.	\$(nodeText.noSymptomCode)	
13.	To completely troubleshoot this issue, the following known-good parts are required. <ul style="list-style-type: none"> I/O flex cable I/O board Do you have immediate access to each of these known-good parts?	Yes	Go to step 14.	\$(nodeText.yesSymptomCode)	
		No	Replace the I/O flex cable. Verify that the issue is resolved.	X03	INTERNAL CABLE

	Check	Result	Action	Code	Commodity
14.	Substitute a known-good I/O flex cable. Attach a known-good power adapter to computer and check LED on power adapter's MagSafe 2 connector. Verify that the MagSafe 2 connector LED lights up green or amber. Does LED turn ON either green or amber?	Yes	Replace the I/O flex cable. Verify that the issue is resolved.	X03	INTERNAL CABLE
		No	Go to step 15.	\$(nodeText.noSymptomCode)	
15.	Substitute a known-good I/O board. Attach a known-good power adapter to computer and check LED on power adapter's MagSafe 2 connector. Verify that the MagSafe 2 connector LED lights up green or amber. Does LED turn ON either green or amber?	Yes	Replace the I/O board. Reinstall user's I/O flex cable. Verify that the issue is resolved.	M30	OTHER BOARD
		No	Replace the logic board. Reinstall user's I/O flex cable and I/O board. Use Blank Board Serializer (BBS) to set the computer's serial number. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	M30	MLB
16.	Press the power button on the keyboard to attempt to turn on the user's computer. Check for any signs of power, such as Caps Lock LED illumination, fan noise, or keyboard backlight. Does computer show any signs of power activity?	Yes	Go to step 17.	\$(nodeText.yesSymptomCode)	
		No	Go to step 19.	\$(nodeText.noSymptomCode)	
17.	Check for a video signal on the built-in display. Is a video image clearly visible on the built-in display?	Yes	The issue cannot be duplicated.	\$(nodeText.yesSymptomCode)	
		No	Go to step 18.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
18.	Clean the display glass of all fingerprints and dirt, then shine a bright light to illuminate the display.	Yes	Go to the “Backlight Issue / No Backlight” troubleshooting flow.	\$(nodeText.yesSymptomCode)	
	The Apple menu icon in the menu bar should always be visible and provides a reliable, high-contrast, and identifiable icon. Does the display show a legible image despite not being backlit?	No	Go to the “Power But Blank/No Video” troubleshooting flow.	\$(nodeText.noSymptomCode)	
19.	Remove the bottom case and disconnect battery. Disconnect Input Devices (IPD) flex cable from logic board.	Yes	Go to step 20.	\$(nodeText.yesSymptomCode)	
	On the logic board there are two power-on pads that can be shorted to power on the computer. Refer to article TP695: Portables: Logic Board Power-On Pads for exact location of each model’s power-on pads. Connect a known-good power adapter. Try to start up computer by shorting logic board power-on pads. Note: Be very careful not to touch any other components to avoid damaging the logic board. Did the computer start up?	No	Go to step 26.	\$(nodeText.noSymptomCode)	
20.	Disconnect the IPD flex cable from the logic board and trackpad. Disconnect the keyboard flex cable from the trackpad.	Yes	Go to step 21.	\$(nodeText.yesSymptomCode)	
	Check for damage on the IPD flex cable and the keyboard flex cable, their connectors, and the trackpad and logic board IPD flex connectors. Inspect connector housings. Look for debris or broken/missing pins that might prevent proper seating. Is there damage to any flex cable or connector?	No	Go to step 25.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
21.	Determine whether damage is limited to one of the following components, or multiple parts are damaged: <ul style="list-style-type: none"> • IPD flex cable • Keyboard flex cable (part of top case) • Trackpad • Logic board Is there damage to multiple parts?	Yes	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	
		No	Go to step 22.	\${nodeText.noSymptomCode}	
22.	Inspect the IPD flex cable for damage. Pay attention to the body of the cable, looking for pinching, tearing, or crimping, and to both ends of the cable. Does the IPD flex cable appear damaged?	Yes	Replace IPD flex cable. Verify that the issue is resolved.	X03	INTERNAL CABLE
		No	Go to step 23.	\${nodeText.noSymptomCode}	
23.	Inspect the top case keyboard flex cable connector for damage. Does the top case keyboard flex cable connector appear damaged?	Yes	Replace the top case assembly. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	K16	KEYBOARD
		No	Go to step 24.	\${nodeText.noSymptomCode}	
24.	Inspect the logic board IPD flex cable connector for damage. Does the logic board IPD flex cable connector appear damaged?	Yes	Replace the logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	M24	MLB
		No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	

	Check	Result	Action	Code	Commodity
25.	Reconnect the keyboard flex cable to the trackpad, ensuring a good connection to the trackpad.	Yes	Issue resolved by reseating flex cable connections. Verify resolution.	\${nodeText.yesSymptomCode}	
	Reconnect the IPD flex cable to the logic board and trackpad, ensuring a good connection to both ends.				
	Continue to use known-good power adapter. Press power button to start up computer. Verify computer powers on and attempts startup.	No	Go to step 26.	\${nodeText.noSymptomCode}	
	Did the computer start up?				
26.	Disconnect IPD flex cable from logic board.	Yes	Replace IPD flex cable. Verify that the issue is resolved.	X03	INTERNAL CABLE
	Connect a known-good power adapter. Try to start up computer by shorting logic board power-on pads.	No	Go to step 27.	\${nodeText.noSymptomCode}	
	Did the computer start up?				
27.	Reconnect IPD flex cable to logic board. Disconnect battery cable from logic board to determine whether battery is preventing computer from receiving power.	Yes	Replace the battery. Verify that the issue is resolved.	P01	BATTERY
	Connect a known-good power adapter. Try to start up computer by shorting logic board power-on pads.	No	Go to step 28.	\${nodeText.noSymptomCode}	
	Did the computer start up?				
28.	Remove wireless card from logic board. Make sure IPD flex cable is connected. Reconnect battery cable to logic board.	Yes	Go to step 29.	\${nodeText.yesSymptomCode}	
	Connect a known-good power adapter. Try to start up computer by shorting logic board power-on pads.	No	Go to step 34.	\${nodeText.noSymptomCode}	
	Did the computer start up?				
29.	The wireless card is connected directly to a socket on the logic board. Remove the bottom case and disconnect battery, then remove the wireless card and inspect the card connector for damage.	Yes	Replace the wireless card. Verify that the issue is resolved.	N17	WIRELESS DEVICE
	Does wireless card connector show any damage?	No	Go to step 30.	\${nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
30.	Inspect the wireless card connector on the logic board for housing or pin damage.	Yes	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M24	MLB
	Does the wireless card connector on the logic board show any damage?	No	Go to step 31.	\$(nodeText.noSymptomCode)	
31.	Reinstall the wireless card on the logic board.	Yes	Issue resolved by reseating the wireless card. Verify resolution.	\$(nodeText.yesSymptomCode)	
	Connect a known-good power adapter and press power button to start up computer.	No	Got to step 32.	\$(nodeText.noSymptomCode)	
32.	Did the computer start up?	Yes	Go to step 33.	\$(nodeText.yesSymptomCode)	
	To troubleshoot this issue completely, a known-good wireless card is required.	No	<p>Replace the wireless card.</p> <p>Verify that the issue is resolved.</p>	N01	WIRELESS DEVICE
33.	Do you have immediate access to a known-good wireless card?	Yes	<p>Replace the wireless card.</p> <p>Verify that the issue is resolved.</p>	N01	WIRELESS DEVICE
	<p>Substitute a known-good wireless card. Connect a known-good power adapter and press power button to start up computer.</p> <p>If computer starts up, verify AirPort and Bluetooth services are present.</p> <p>Did the computer start up?</p>	No	<p>Replace the logic board.</p> <p>Reinstall user's wireless card.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M01	MLB

	Check	Result	Action	Code	Commodity
34.	Disconnect internal display eDP (Embedded DisplayPort) cable from logic board.	Yes	Go to step 35.	\$(nodeText.yesSymptomCode)	
	Connect a known-good power adapter. Try to start up computer by shorting logic board power-on pads.	No	Go to step 41.	\$(nodeText.noSymptomCode)	
	Did the computer start up?				
35.	Inspect the eDP flex cable for damage. Look for pinching or crimping, and damaged or bent pins.	Yes	Go to step 36.	\$(nodeText.yesSymptomCode)	
	Does the eDP flex cable show signs of damage?	No	Go to step 37.	\$(nodeText.noSymptomCode)	
36.	Inspect the logic board display connector for damage, paying attention to both the conductors and the locking bar.	Yes	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	\$(nodeText.yesSymptomCode)	
	Is the connector on the logic board also damaged?	No	Replace the display clamshell. Verify that the issue is resolved.	L14	LCD
37.	Inspect the logic board display connector for damage, paying attention to both the conductors and the locking bar.	Yes	Replace the logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	M24	MLB
	Does the connector on the logic board show signs of damage?	No	Go to step 38.	\$(nodeText.noSymptomCode)	
38.	Reseat the eDP flex cable connections on the logic board.	Yes	The issue was resolved by reseating the eDP flex cable. Verify resolution.	\$(nodeText.yesSymptomCode)	
	Connect a known-good power adapter. Try to start up computer by shorting logic board power-on pads.	No	Go to step 39.	\$(nodeText.noSymptomCode)	
	Did the computer start up?				

	Check	Result	Action	Code	Commodity
39.	To troubleshoot this issue completely, a known-good display clamshell is required. Do you have immediate access to a known-good display clamshell?	Yes	Go to step 40.	\$(nodeText.yesSymptomCode)	
		No	Replace the display clamshell. Verify that the issue is resolved.	L01	LCD
40.	Substitute a known-good display clamshell. Connect a known-good power adapter. Try to start up computer by shorting logic board power-on pads. Did the computer start up?	Yes	Replace the display clamshell. Verify that the issue is resolved.	L01	LCD
		No	Replace the logic board. Reinstall user's display clamshell. Use Blank Board Serializer (BBS) to set the computer's serial number. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	M01	MLB
41.	Disconnect flash storage card from logic board. Connect a known-good power adapter. Try to start up computer by shorting logic board power-on pads. Did the computer start up?	Yes	Go to step 42.	\$(nodeText.yesSymptomCode)	
		No	Replace the logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	M01	MLB
42.	Inspect flash storage for damage to logic board connector. Look for connector pin damage and missing or bent pins on logic board connector that could prevent correct seating. Did you find damage to flash storage or logic board connectors?	Yes	Go to step 43.	\$(nodeText.yesSymptomCode)	
		No	Go to step 44.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
43.	Inspect the logic board flash storage connector for damage.	Yes	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	H99	
	Is the connector on the logic board also damaged?	No	Replace the user's flash storage card. Verify that the issue is resolved.	H04	SSD
44.	Reconnect user's flash storage. Verify that the flash storage module is properly seated to the logic board connector.	Yes	The issue was resolved by reseating flash storage. Verify resolution.	\$(nodeText.yesSymptomCode)	
	Connect a known-good power adapter. Try to start up computer by shorting logic board power-on pads. Did the computer start up?	No	Go to step 45.	\$(nodeText.noSymptomCode)	
45.	To troubleshoot this issue completely, a known-good bootable flash storage card is required.	Yes	Go to step 46.	\$(nodeText.yesSymptomCode)	
	Do you have immediate access to a known-good flash storage card?	No	Replace the user's flash storage card. Verify that the issue is resolved.	H02	SSD
46.	Substitute known-good flash storage. Connect a known-good power adapter. Try to start up computer by shorting logic board power-on pads. Did the computer start up?	Yes	Replace the user's flash storage card. Verify that the issue is resolved.	H02	SSD
		No	Replace the logic board. Reinstall user's display clamshell. Use Blank Board Serializer (BBS) to set the computer's serial number. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	M01	MLB

	Check	Result	Action	Code	Commodity
47.	Verify that the computer can now complete the startup process over multiple trials.	Yes	The issue is resolved.	\${nodeText.yesSymptomCode}	
	Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.	No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	
	Verify that the issue is resolved.				
	Is the issue resolved?				

Power Adapter Issues

Unlikely causes:

Wireless card, battery, bottom case, display clamshell, fan, flash storage, heat sink, logic board, speakers, top case, trackpad

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">Computer does not detect attached power adapterNo MagSafe 2 LED illuminationBattery not charging <p>Note: Inform the user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables.</p>	<ol style="list-style-type: none">Verify that you are using a functional power outlet.Disconnect all peripherals.Verify that the user's power adapter is the correct model for the user's computer. Refer to article HT201700: Find the right power adapter and cord for your Mac notebook. Different power adapters may appear similar but may not provide sufficient power to turn on or charge the computer.Reset the SMC using the procedure for this computer in article HT201295: Reset the System Management Controller (SMC) on your Mac.Refer to HT203207: Troubleshooting MagSafe adapters. Check for debris, stuck pins, or dirty MagSafe 2 connectors on both the power adapter and the power port on computer. Remove debris, clean connectors, and adjust stuck pins as necessary.Connect the user's power adapter to a known-good computer and run AST or AST 2 Power Adapter Diagnostic to confirm that the power adapter is functioning. <p>Warning: If a power cord or duckhead is damaged, do not connect it to power.</p> <ol style="list-style-type: none">If the battery is drained on the user's computer, connect it to a known-good power adapter with a known-good charging cable and charge the computer for up to 10 minutes to verify that the computer's battery can charge. If the user's computer does not charge with a known-good power adapter, return to the list of symptoms and select "Battery Not Recognized or Does Not Charge" from the troubleshooting menu.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Inspect the user's power adapter, power cord, and duckhead for damage.	Yes	Go to the "Mechanical/Physical/Cosmetic Damage" troubleshooting flow.	\$(nodeText.yesSymptomCode)	
	Check the MagSafe 2 connector on the user's power adapter and computer for contamination, debris, or damaged pins.	No	Go to step 2.	\$(nodeText.noSymptomCode)	
	Does the user's power adapter or duckhead appear damaged?				

	Check	Result	Action	Code	Commodity
2.	<p>Attach user's power adapter to computer and check LED on power adapter's MagSafe 2 connector.</p> <p>Verify that the MagSafe 2 connector LED turns on either green or amber.</p> <p>Does LED turn ON either green or amber?</p>	Yes	Go to step 3.	\$(nodeText.yesSymptomCode}	
		No	Go to step 7.	\$(nodeText.noSymptomCode}	
3.	<p>Attach a known-good, compatible power adapter to computer and check LED on power adapter's MagSafe 2 connector.</p> <p>Verify that the MagSafe 2 connector LED turns on either green or amber.</p> <p>Does LED turn ON either green or amber?</p>	Yes	Go to step 4.	\$(nodeText.yesSymptomCode}	
		No	Go to the "No Power" troubleshooting flow.	\$(nodeText.noSymptomCode}	
4.	<p>Press the power button on the keyboard to attempt to turn on the user's computer.</p> <p>Check for any signs of power, such as Caps Lock LED illumination, fan noise, or keyboard backlight.</p> <p>Does computer show any signs of power activity?</p>	Yes	Go to step 5.	\$(nodeText.yesSymptomCode}	
		No	Go to the "No Power" troubleshooting flow.	\$(nodeText.noSymptomCode}	
5.	<p>Check the Power section of System Information on the user's computer for AC Charger Information to verify that the computer recognizes the known-good power adapter.</p> <p>Then substitute the user's power adapter and recheck the Power section of System Information for AC Charger Information to verify that the computer recognizes the user's power adapter.</p> <p>Does the computer recognize the user's power adapter?</p>	Yes	Go to step 6.	\$(nodeText.yesSymptomCode}	
		No	Replace the power adapter. Verify that the issue is resolved.	P23	ADAPTER
6.	<p>Run AST or AST 2 Power Adapter diagnostics on the user's computer with the user's power adapter connected, to confirm that the user's power adapter is functioning.</p> <p>Do all tests pass?</p>	Yes	Issue cannot be duplicated.	\$(nodeText.yesSymptomCode}	
		No	Go to step 7.	\$(nodeText.noSymptomCode}	

	Check	Result	Action	Code	Commodity
7.	Substitute the user's duckhead / power cord for a known-good duckhead or power cord.	Yes	Replace the power cord / duckhead. Verify that the issue is resolved.	X03	EXTERNAL CABLE
	Retest with AST or AST 2 Power Adapter diagnostics.	No	Replace the power adapter. Verify that the issue is resolved.	P23	ADAPTER
	Do all tests pass?				
8.	Test the power adapter, power cord, and/or duckhead to confirm that the MagSafe 2 LED lights up, the computer receives power, and the battery charges.	Yes	Issue resolved.	\$(nodeText.yesSymptomCode)	
	Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain.	No	ESCALATION REQUIRED.	P99	
	Verify that the issue is resolved.		Contact ACS for additional support or a multiple-part repair.		
	Is the issue resolved?				

Will Not Start Up

Unlikely causes:

Battery, bottom case, fan, heat sink, power adapter, speakers, top case

Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none">Blank black screen with backlightSome video activity, Apple logo, progress barProhibitory sign or folder with a flashing question markError beep tonesCaps Lock LED toggles on and off when pressed <p>Note: Inform the user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to article OP14: SERVICE: Determining and quoting accidental damage for Mac portables.</p>	<ol style="list-style-type: none">Disconnect any peripherals.Reset the SMC using the procedure listed for this computer in article HT201295: Resetting the System Management Controller (SMC) on your Mac.Reset the NVRAM using the procedure for this computer in article HT204063: How to Reset NVRAM on your Mac.Start up from Mac Resource Inspector (MRI), check for the presence of an installed macOS, then refer to article HT204319: macOS versions and builds included with Mac computers to check that the system build is correct for this computer model.Attempt to start up from Internet Recovery or an external, bootable volume with a compatible build of macOS.If the battery is drained on the user's computer, connect it to a known-good power adapter and charge the computer for up to 10 minutes to verify that the computer's battery can charge. If the user's computer does not charge with a known-good power adapter, return to the list of symptoms and select the "Battery Not Recognized or Does Not Charge" troubleshooting flow.

Deep Dive

	Check	Result	Action	Code	Commodity
1.	Press the power button on the keyboard to attempt to turn on the user's computer.	Yes	Go to step 2.	\$(nodeText.yesSymptomCode)	
	Check for any signs of power, such as Caps Lock LED illumination, fan noise, or keyboard backlight.	No	Go to the "No Power" troubleshooting flow.	\$(nodeText.noSymptomCode)	
	Does computer show any signs of power activity?				

	Check	Result	Action	Code	Commodity
2.	<p>A memory error is indicated by a number of beep tones.</p> <p>Refer to HT202768: About Mac startup tones and HT201702: Intel-based Mac Power-On Self-Test RAM error codes for more information on startup and error sounds and their meaning.</p> <p>Does the beep tones sequence indicate a memory error?</p>	Yes	<p>Replace the logic board.</p> <p>Use Blank Board Serializer (BBS) to set the computer's serial number.</p> <p>Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller.</p> <p>Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions.</p> <p>Verify that the issue is resolved.</p>	M39	MLB
		No	Go to step 3.	\$(nodeText.noSymptomCode)	
3.	<p>Observe startup to verify whether the boot process displays the initial gray screen after the startup sound.</p> <p>Does computer reach a gray screen during the startup process?</p>	Yes	Go to step 4.	\$(nodeText.yesSymptomCode)	
		No	Go to the "Power But Blank/No Video" troubleshooting flow.	\$(nodeText.noSymptomCode)	
4.	<p>Verify that the computer completes the startup process: startup sound > gray screen > Apple logo > spinning gear > login screen.</p> <p>Does computer complete startup process to login screen?</p>	Yes	The issue cannot be duplicated.	\$(nodeText.yesSymptomCode)	
		No	Go to step 5.	\$(nodeText.noSymptomCode)	
5.	<p>Start up the computer and determine whether a kernel panic is occurring.</p> <p>Refer to HT200553: When your computer spontaneously restarts or displays "Your computer restarted because of a problem."</p> <p>Does computer display a kernel panic during startup?</p>	Yes	Go to the "Kernel Panic / System Crashes" troubleshooting flow.	\$(nodeText.yesSymptomCode)	
		No	Go to step 6.	\$(nodeText.noSymptomCode)	
6.	<p>Remove the bottom case and disconnect battery, then disconnect the flash storage card from the logic board.</p> <p>Start up the computer using a known-good, bootable macOS volume.</p> <p>Does the computer start up with flash storage card removed?</p>	Yes	Go to the "Flash Storage Not Recognized / Not Mounting / Read/Write Issues" troubleshooting flow.	\$(nodeText.yesSymptomCode)	
		No	Go to step 7.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
7.	Reinstall the user's flash storage card. Disconnect the wireless card from the logic board. Start up the computer using a known-good, bootable macOS volume. Does the computer start up with wireless card removed?	Yes	Go to step 8.	\$(nodeText.yesSymptomCode)	
		No	Replace the logic board. Reinstall user's wireless card. Use Blank Board Serializer (BBS) to set the computer's serial number. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	M05	MLB
8.	Inspect the wireless card connector for damage. Does wireless card connector show any damage?	Yes	Replace the wireless card. Verify that the issue is resolved.	N17	WIRELESS DEVICE
		No	Go to step 9.	\$(nodeText.noSymptomCode)	
9.	Inspect the wireless card connector on the logic board for housing or pin damage. Does the wireless card connector on the logic board show any damage?	Yes	Replace the logic board. Use Blank Board Serializer (BBS) to set the computer's serial number. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	M24	MLB
		No	Go to step 10.	\$(nodeText.noSymptomCode)	

	Check	Result	Action	Code	Commodity
10.	Reinstall the wireless card on the logic board.	Yes	Issue resolved by reseating the wireless card. Verify resolution.	\$(nodeText.yesSymptomCode)	
	Connect a known-good power adapter and press power button to start up computer.				
	Did the computer start up?	No	Go to step 11.	\$(nodeText.noSymptomCode)	
11.	To troubleshoot this issue completely, a known-good wireless card is required.	Yes	Go to step 12.	\$(nodeText.yesSymptomCode)	
	Do you have immediate access to a known-good wireless card?	No	Replace the wireless card. Verify that the issue is resolved.	N13	WIRELESS DEVICE
12.	Substitute a known-good wireless card. Connect a known-good power adapter and press power button to start up computer. If computer starts up, verify AirPort and Bluetooth services are present. Did the computer start up?	Yes	Replace the wireless card. Verify that the issue is resolved.	N13	WIRELESS DEVICE
		No	Replace the logic board. Reinstall user's wireless card. Use Blank Board Serializer (BBS) to set the computer's serial number. Run Trackpad Keyboard Mapper utility to set correct keyboard language in trackpad controller. Refer to TP1016: Using the Trackpad Keyboard Mapper for instructions. Verify that the issue is resolved.	M05	MLB
13.	Verify that the computer can now complete the startup process over multiple trials.	Yes	The issue is resolved. Verify resolution.	\$(nodeText.yesSymptomCode)	
	Run ASD or AST 2 Full System Diagnostic (EFI & OS), if available, to ensure no other issues remain. Verify that the issue is resolved. Is the issue resolved?	No	ESCALATION REQUIRED. Contact ACS for additional support or a multiple-part repair.	X99	

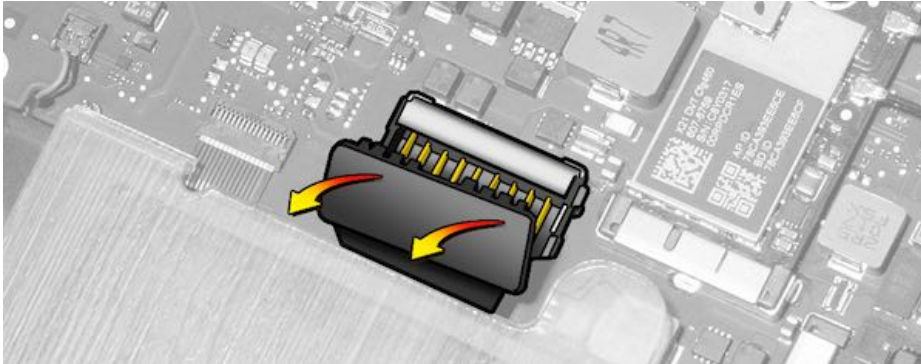
Connector Types on Logic Board

On the logic board are six different types of connectors, each requiring special handling. Make sure you read these tips before disconnecting and installing the connectors.

Battery Connector:

- Use black stick or fingernails to pull up evenly.
- Align connector over receptacle and press onto board when reconnecting.

For video instruction, refer to article [SV79: Battery Connectors Video](#).



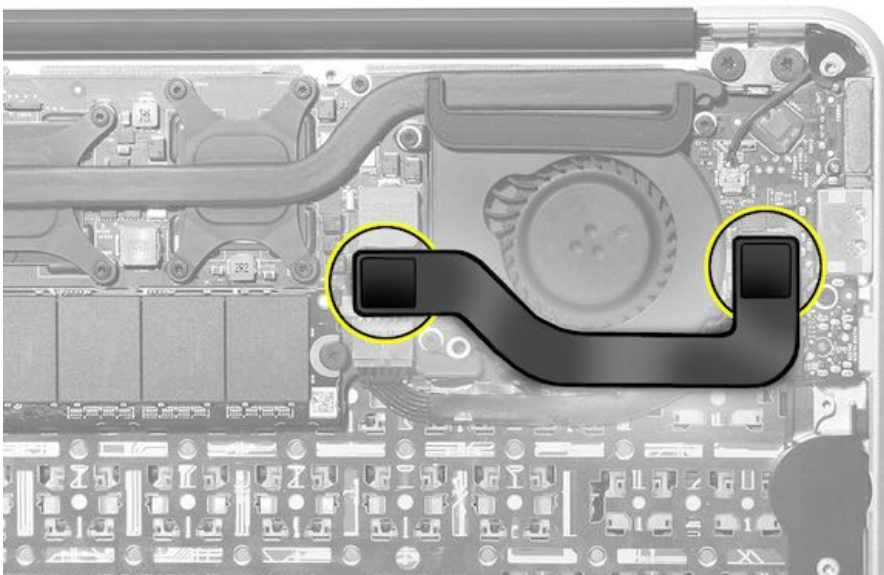
Low-Profile Solid Platform Flex

- Use black stick to release connector straight up.
- Keep connector level with board and press evenly to install cable.

Examples:

- I/O flex cable

For video instruction, refer to article [SV89: Solid Platform Flex Connectors Video](#).



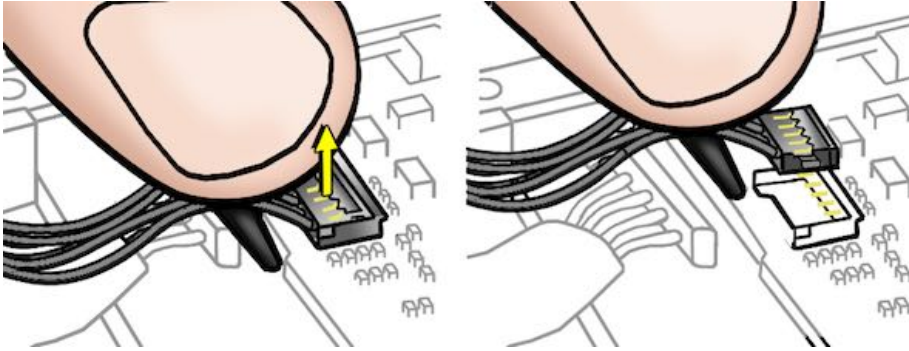
Vertical Insertion

- Use black stick under cable to remove.
- Keep connector level with board when disconnecting and reconnecting.
- Press evenly when reconnecting or connector can be tipped up and not fully seated.

Examples:

- right speaker
- left speaker

For video instruction, refer to article [SV83: Japan Solderless Terminal \(JST\) Connectors Video](#).



Locking Lever

- Flip lever up 90 degrees for cable removal and insertion.
- Slide connector into receptacle on the same horizontal plane as logic board.
- Lock down lever after inserting cable.
- Close lever when handling or shipping a loose logic board, whether a known-good or a known-bad board.

Examples:

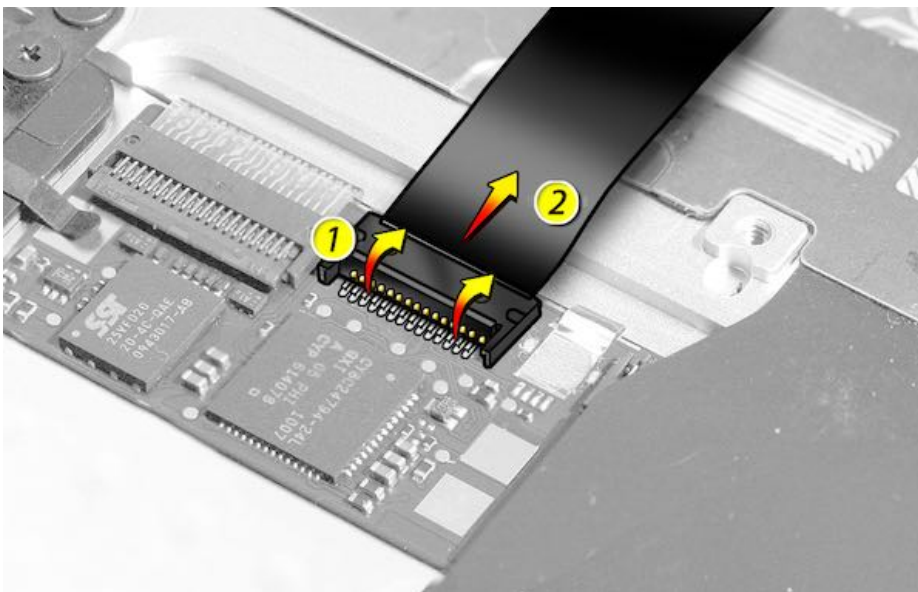
- IPD flex cable
- keyboard flex cable
- fan
- microphone

Caution: The locking lever cable connectors at the keyboard flex cable (IPD), fan cable, microphone cable, and keyboard backlight cable are fragile. To protect the levers during handling or shipment of the logic board, **close** the levers after the cables are removed. Once the logic board is back in the top case and the cables are installed, be sure to lock down the levers.



Caution: Use black stick to push IPD flex cable **all the way** into connector to prevent "no power" symptoms.

For video instruction, refer to article [SV85: Locking Lever Connectors Video](#).



Thin, Multi-Pin Horizontal Insert

- Use black stick on alternating sides to evenly disconnect cable.

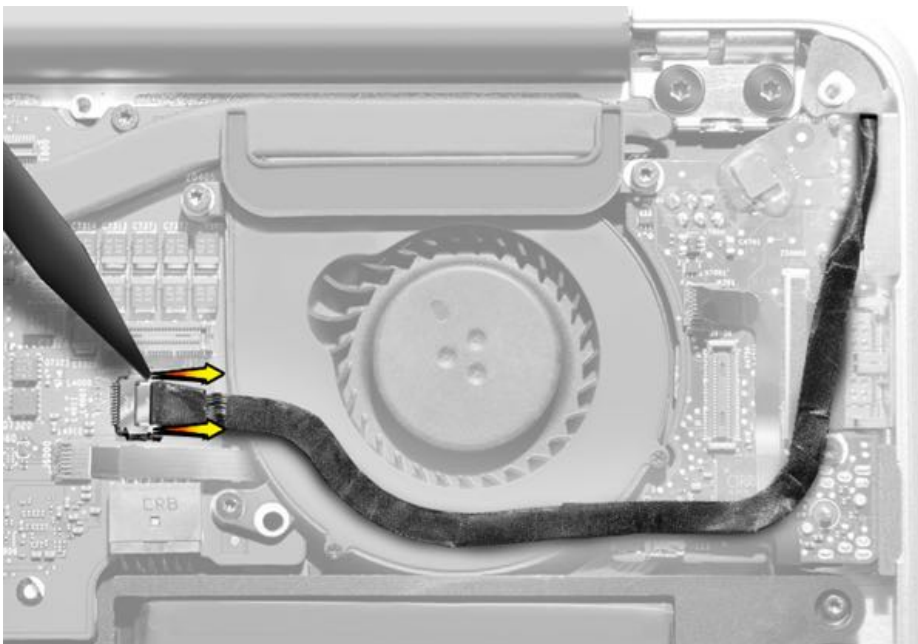
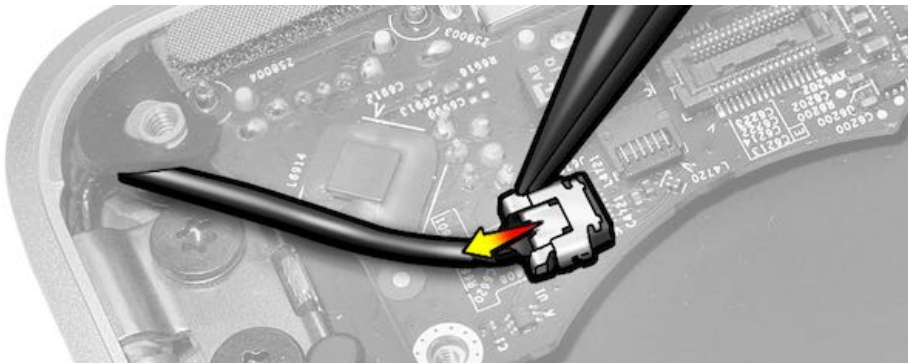
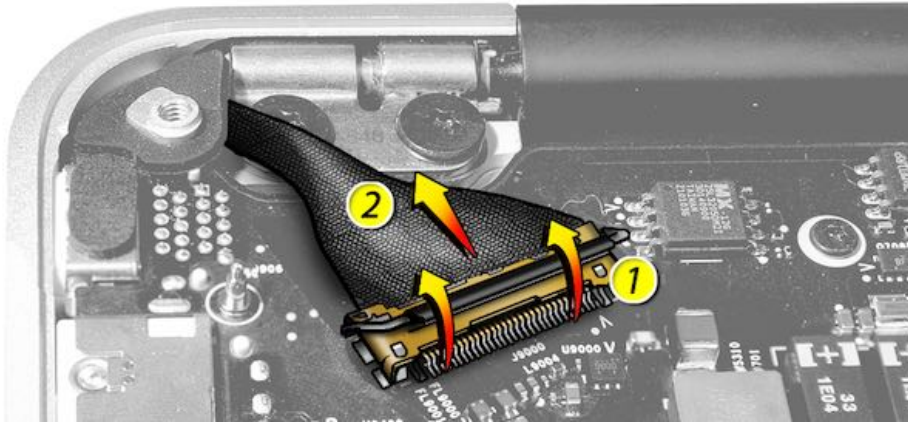
- Slide connector into receptacle on same horizontal plane as board.

Examples:

- eDP cable
- camera cable

Note: Flip over lock bar before disconnecting eDP cable, but do not use bar as a handle. When cable is fully installed, flip lock bar over leads to secure cable in place.

For video instruction, refer to article [SV87: Multi-Pin Horizontal Insert Connectors Video](#).



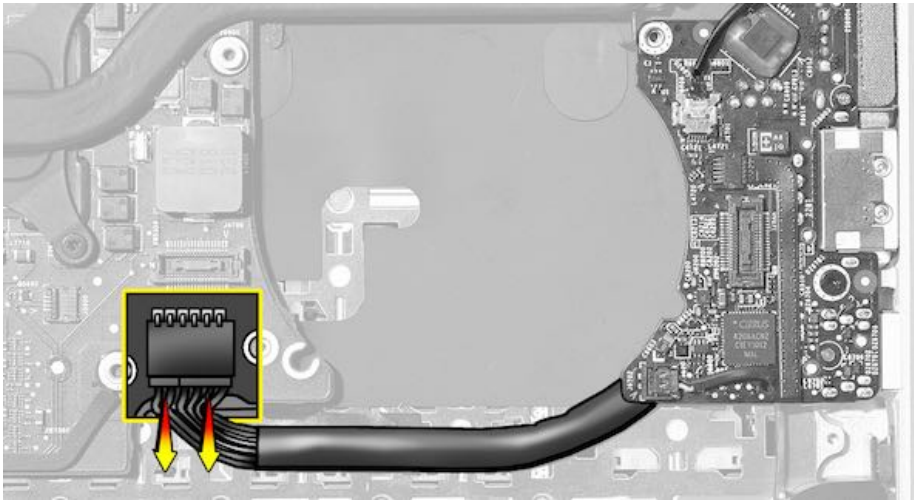
Horizontal Install

- Pull connector, not cable, to remove.
- Slide connector into receptacle on same horizontal plane as board.

Example shown:

- I/O power cable

For video instruction, refer to article [SV81: Horizontal-Install Connectors Video](#).



Tools

Tools for MacBook Air (11-inch, Late 2010, Mid 2011, Mid 2012, Mid 2013, Early 2014, Early 2015)

Caution: To prevent scratches or other cosmetic damage to the computer housing, use a soft cloth as a protective layer when removing and installing the external screws.

The following tools are required to service this computer:

- Clean, soft, lint-free cloth
- ESD-safe workstation, including ESD mat and wrist or heel strap
- ESD bags (for storing ESD-sensitive parts while removed from unit)
- Pentalobe screwdriver (923-0731)
- Protective battery cover (kit 076-1372, or cover only 922-9736)
- Phillips #000 screwdriver, magnetized
- Torx T5 screwdriver, magnetized
- Torx T8 screwdriver, magnetized
- Black stick (nylon probe tool, 922-5065) or other nonconductive nylon or plastic flat-blade tool
- ESD-safe plastic or nylon tweezers for routing antenna cables
- Thermal grease syringe (922-7144)
- Alcohol wipes
- Kapton tape
- Permanent ink, fine-point pen
- Magnifying glass, for reading serial number etched on bottom case
- Digital volt meter (troubleshooting)

If available, a torque driver that measures in Kg/cm is recommended for replacing screws.

Electrostatic Discharge (ESD) Precautions

Proper ESD precautions must always be used when servicing this product. Make sure you are working on a properly grounded ESD-safe mat and are wearing a properly connected ESD-safe wrist strap.

For more information about ESD, refer to:

- [OP100: Electrostatic Discharge Precautions and Myths](#)
- [ATLAS: ESD Precautions](#)

First Steps Overview

First Steps Overview for MacBook Air (11-inch, Mid 2013, Early 2014, and Early 2015)

The following chart shows the parts that must be removed before a take-apart procedure can be performed. Starting at the Parts column, find the part that interests you. Read across that row to see which parts in the First Steps must be removed before performing your part removal steps. Black square = remove part; white square = disconnect battery cable.

FIRST STEPS

PARTS

	Bottom Case	Battery	Right Speaker	Left Speaker	Flash Storage	Wireless Card	I/O Flex Cable	Fan	I/O Board	IPD Flex Cable	Heat sink	Logic Board	Trackpad	Display Module	Wireless Cable Labels	Display Clutch Cover	Top Case
Bottom Case																	
Battery	■																
Right Speaker	■	■															
Left Speaker	■	■					■										
Flash Storage	■	□															
Wireless Card	■	□															
I/O Flex Cable	■	□															
Fan	■	□					■										
I/O Board	■	■					■	■									
IPD Flex Cable	■	■															
Heat Sink	■	□						■									
Logic Board *	■	■				■	■	■			■						
Trackpad	■	■															
Display Module	■	■			■		■	■	■			■					
Wireless Cable Labels	■	■			■		■	■	■			■		■			
Display Clutch Cover	■	■			■		■	■	■			■		■			
Top Case **	■	■	■	■	■		■	■	■	■		■	■	■			

Notes

* If logic board is being replaced by a new logic board, remove and transfer the heat sink, flash storage, and wireless card.

** Top case comes with the following: keyboard, microphone, wireless cable labels, and gaskets.

Take Apart Procedure Notes

Reassembly Steps

When no replacement steps are listed, replace parts in exact reverse order of Removal procedure.

Note About Images in This Guide

In some cases a pre-production model may have been used to document the procedures in this guide. Although there may be small differences in appearance between the image pictured and the computer you are servicing, the procedures are the same unless noted.

Screw Sizes

All screw sizes shown are approximate and represent the total length of the screw.



Bottom Case

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT202594: Exams for Service Technicians](#).

For video instruction, refer to article [SV182: Bottom Case Replacement Video](#).

- Shut down computer.
- Unplug all cables.
- Put on ESD strap.
- Place computer on a clean, flat surface.



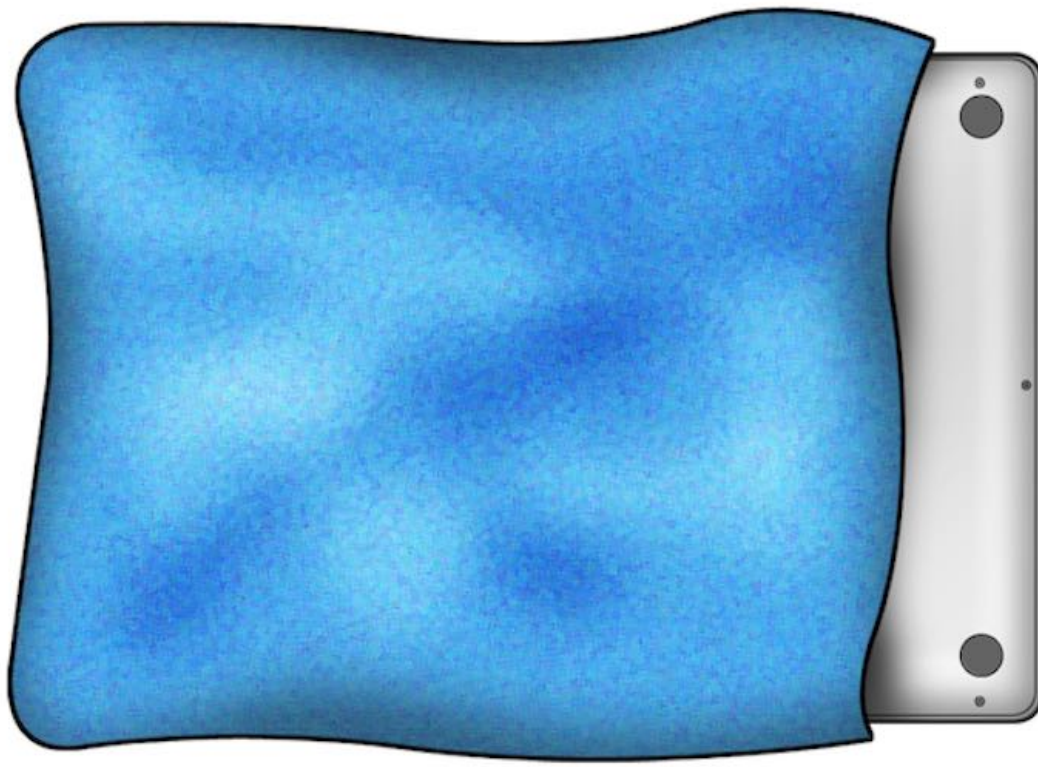
Tools

- ESD wrist strap
- Clean, soft, lint-free cloth
- Pentalobe screwdriver
- Black stick
- Fine-tip, permanent ink pen (not shown)



Steps For Removal

Caution: To prevent scratches, use a protective cloth when working with metal tools.



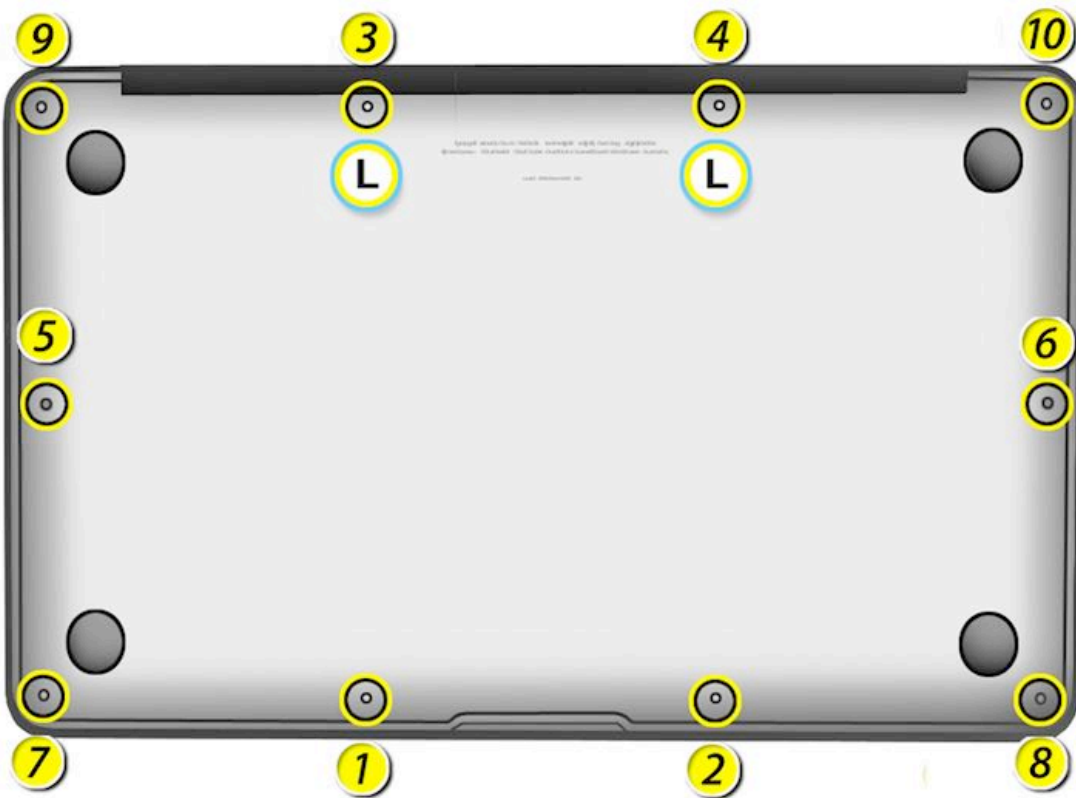
1. Remove 10 Pentalobe security screws (L = long):

- (2 L) 922-9686 (7.9 mm)



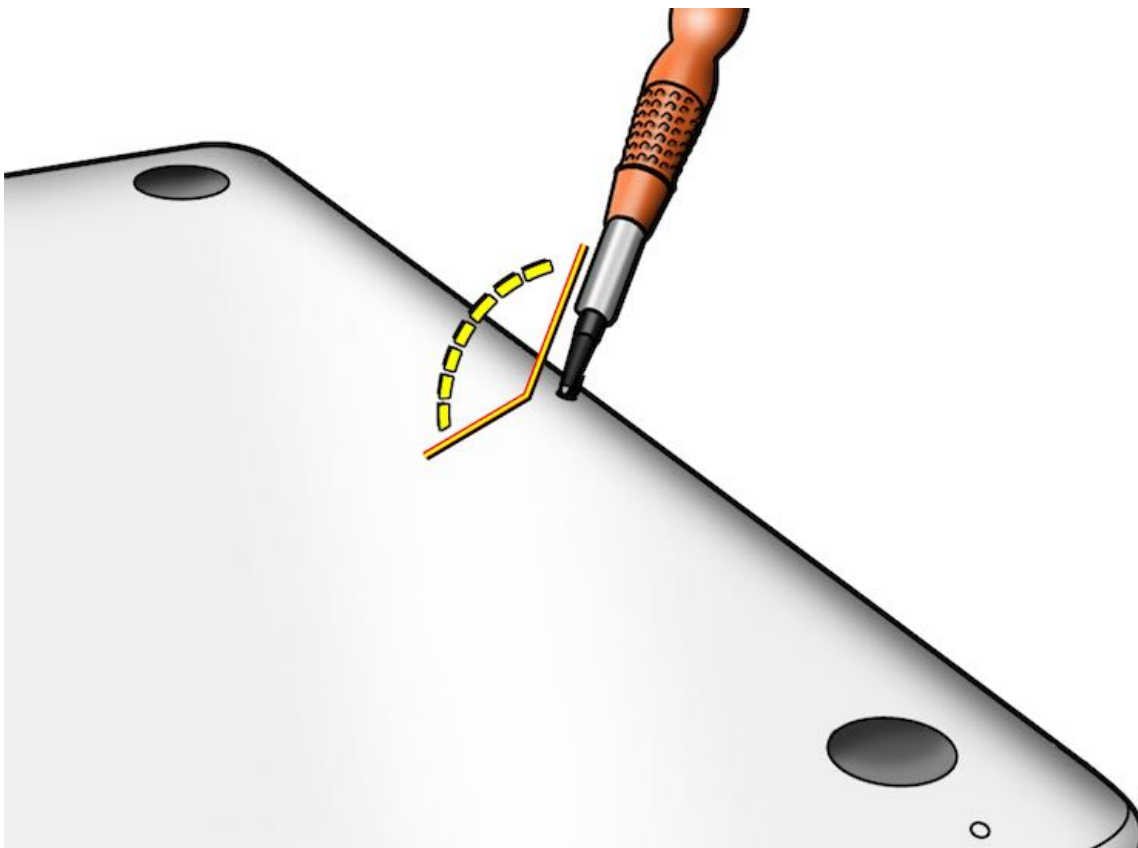
- (8) 922-9685 (2.48 mm)





Important: Screws must be removed and installed at an angle.

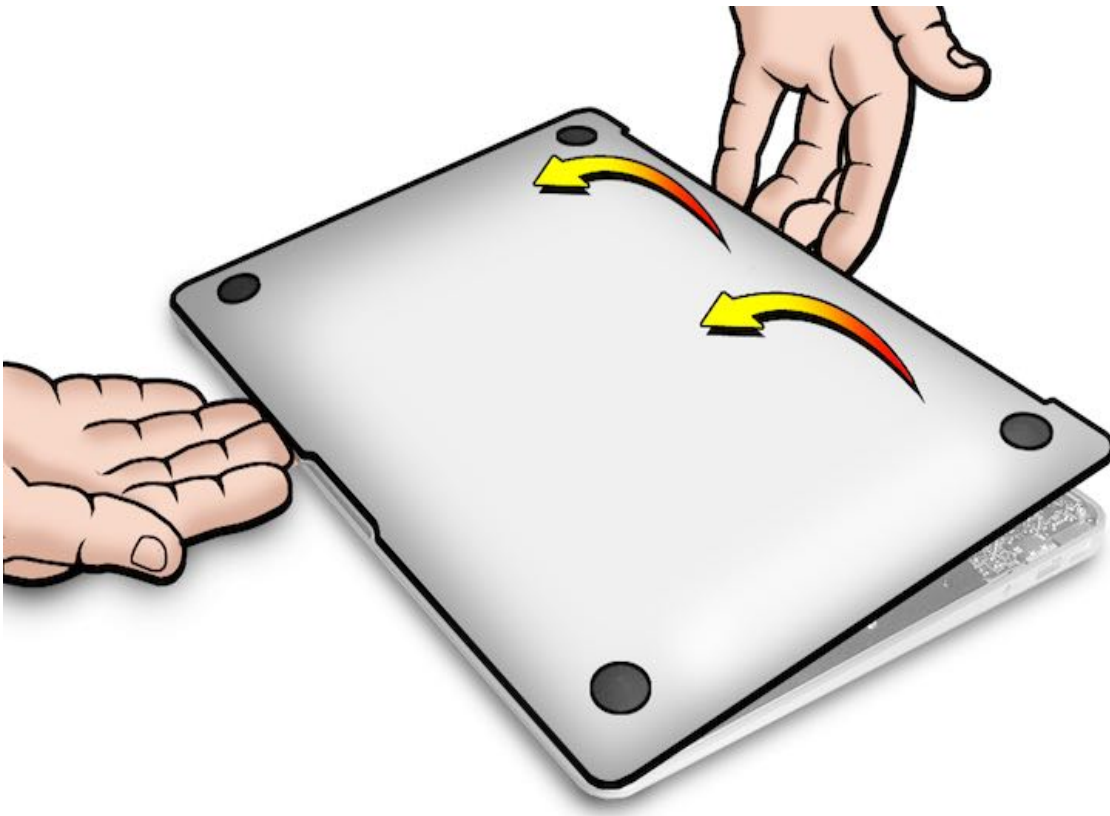
Reassembly Note: Install screws in order shown above. If sequence is not followed, bottom case might wobble when placed on level surface.



2. Lift from top edge and remove bottom case.



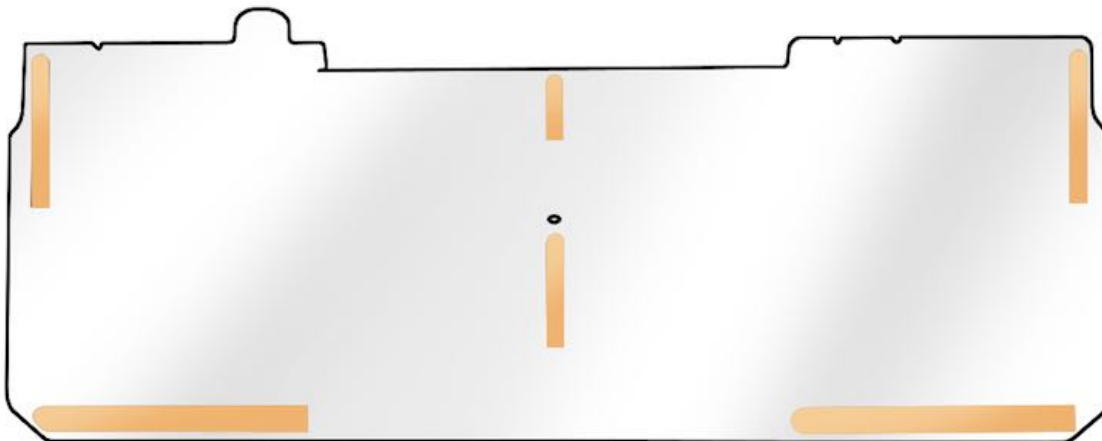
Important: Always attach the battery cover immediately after removing the bottom case if performing any other procedures.



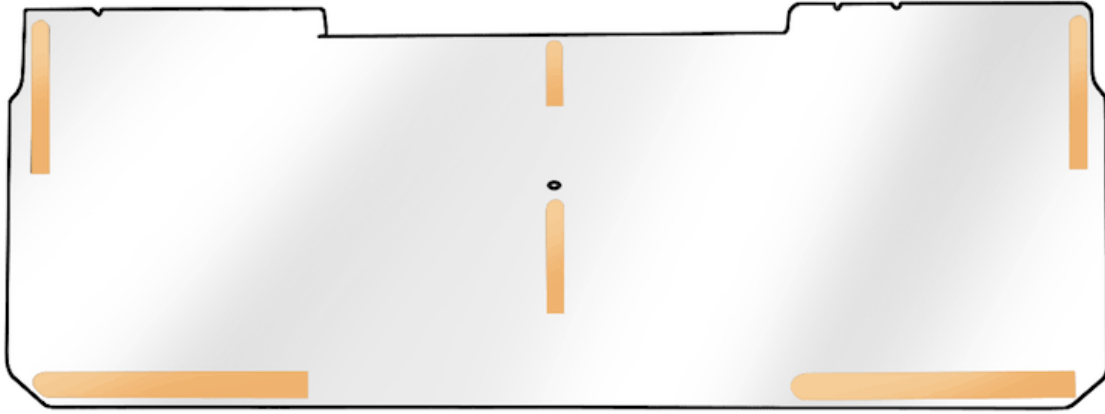
Important: Every time you remove the bottom case, attach the protective battery cover and disconnect the battery cable from the logic board. Refer to [Battery Safety Precautions](#).

3. Remove adhesive strips from clean battery cover.

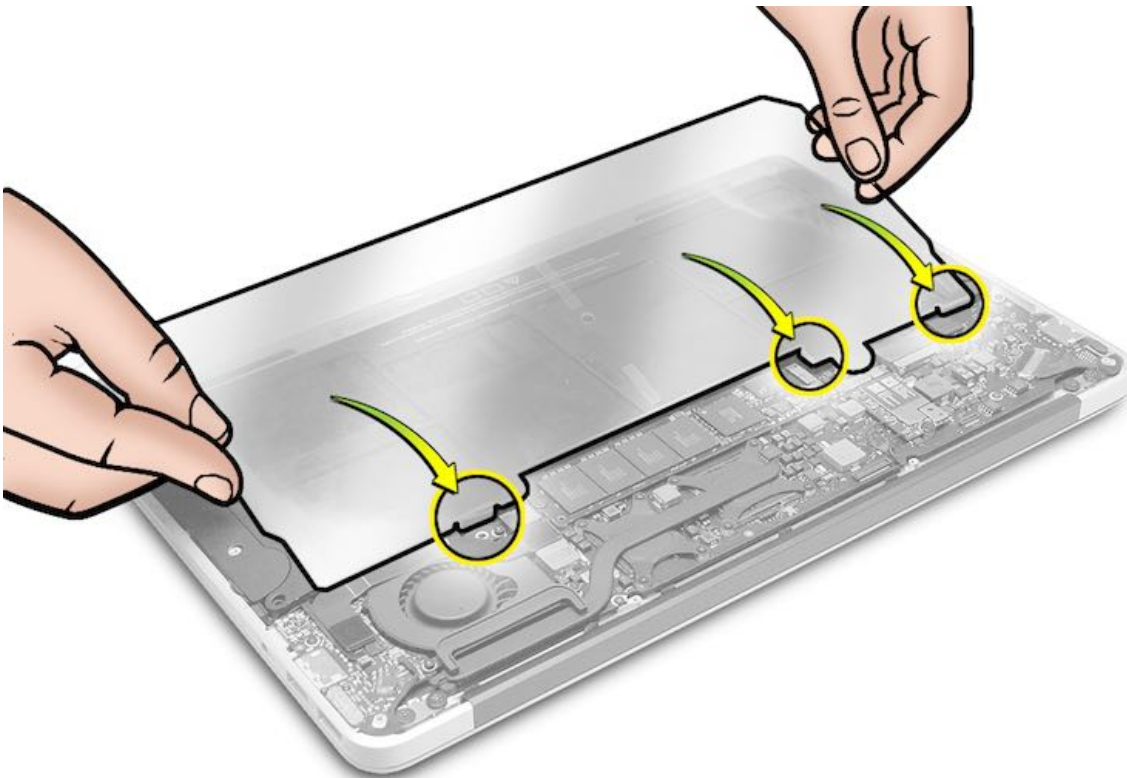
Late 2010



Mid 2011, Mid 2012, Mid 2013, Early 2014, Early 2015

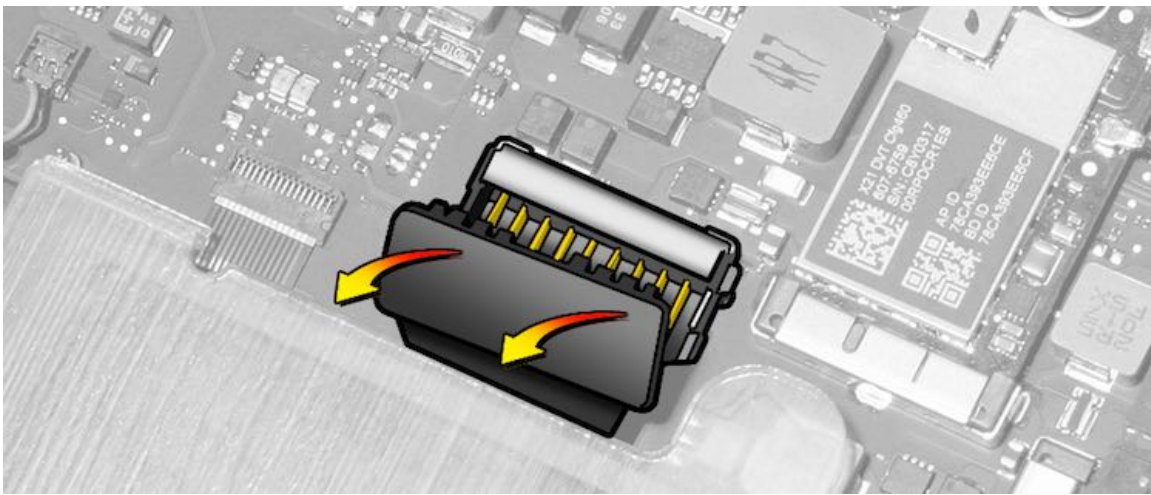


4. Using the hooks at the top of the battery cover, tilt the cover onto the battery.
5. Gently secure cover by running your finger over the parts of the cover that have adhesive.



6. Pull battery connector straight up from logic board.

Important: Disconnect the battery connector whenever performing repairs. You do not need to remove the battery unless it blocks the module being repaired.



Steps For Reassembly

Notes:

- If you are installing a replacement bottom case, use a fine-tip, permanent ink pen to write the original serial number inside the bottom case.
- Remove battery cover just before installing bottom case.

1. Make sure bottom case is clean and free of debris.
2. Install bottom case from the front, and press lightly so that internal clip snaps onto battery.

Caution: The bottom case clip can puncture a cell if the bottom case is installed incorrectly.

3. Confirm all screw holes align before installing screws.

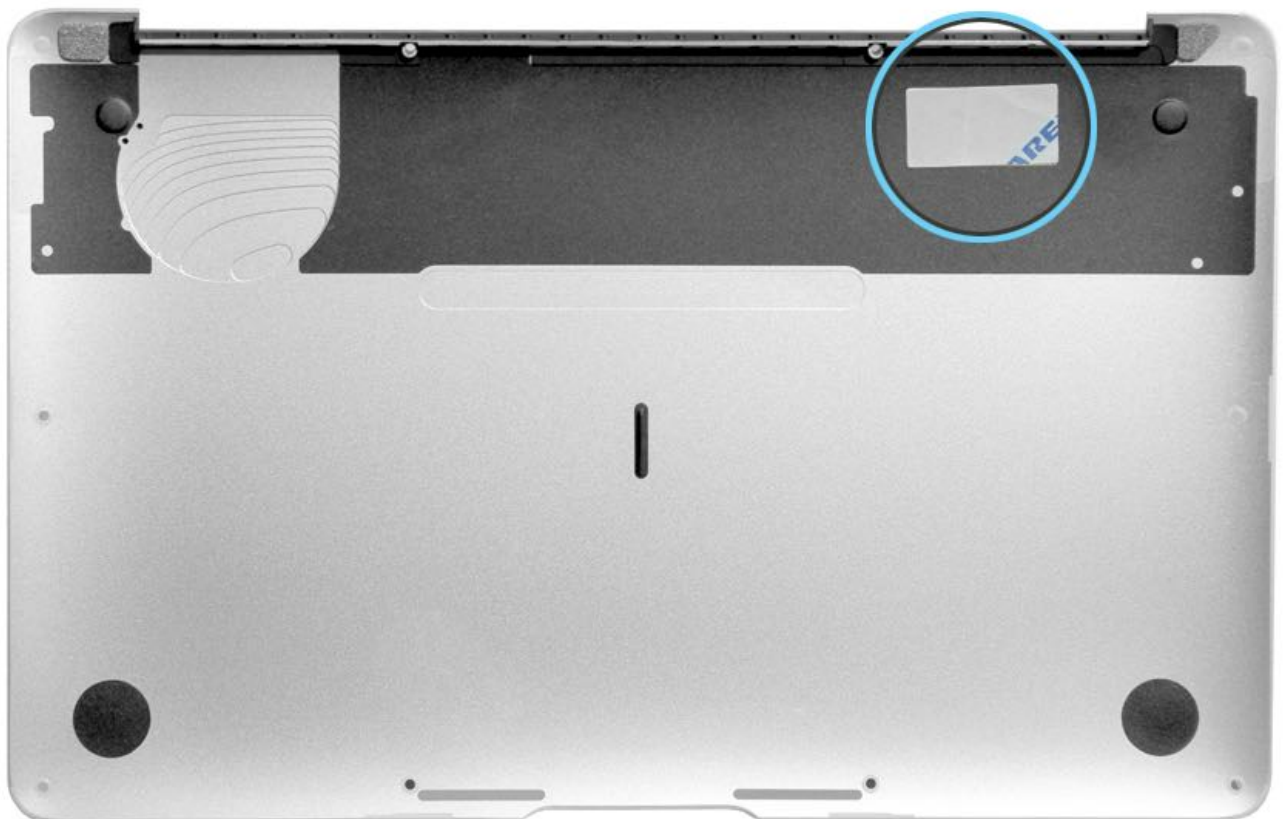


Note: The Mid 2012, Mid 2013, Early 2014, and Early 2015 bottom case can be identified by two foam pads in the top right and left corners.

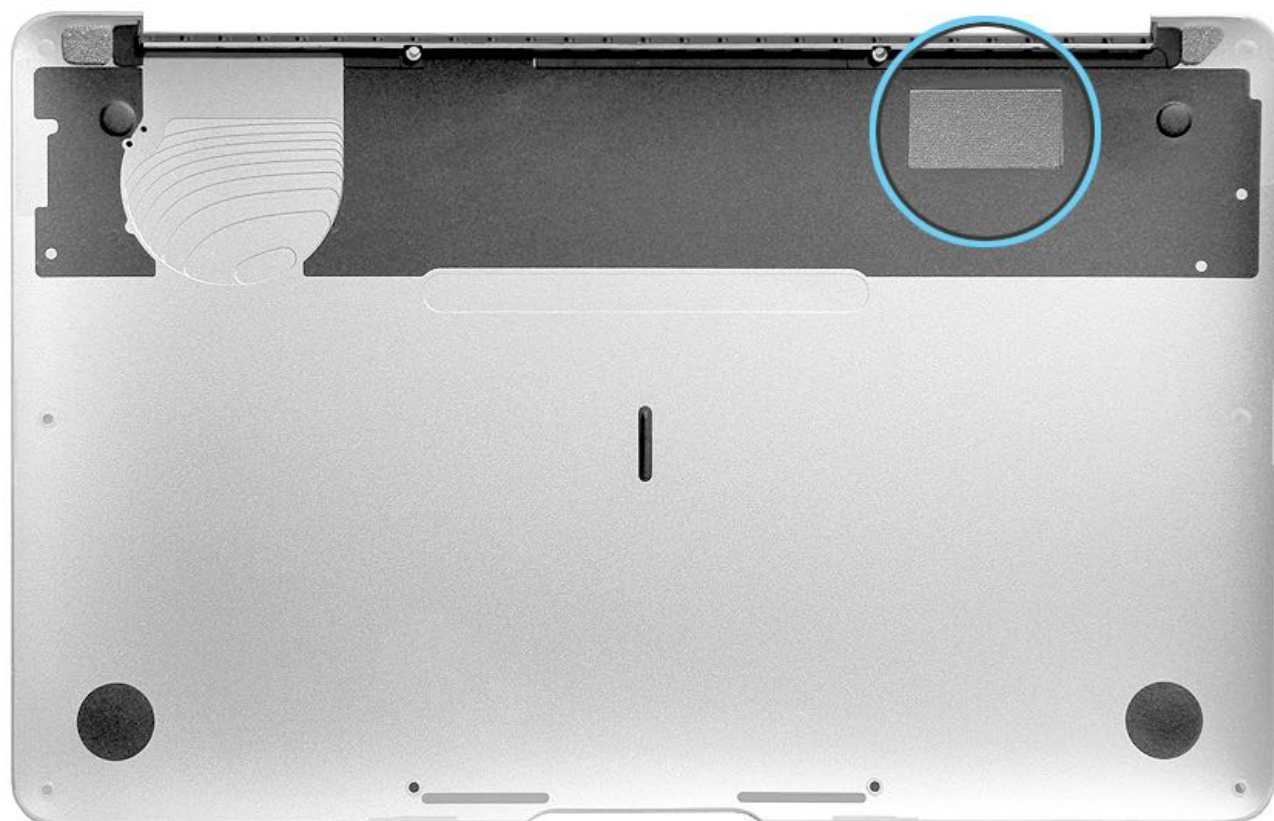


Note: Another way to identify the Mid 2012, Mid 2013, Early 2014, and Early 2015 bottom case is the raised thermal pad for the wireless card. Peel off the adhesive backing before installing a replacement bottom case.

Thermal Pad with Adhesive Backing



Thermal Pad with Adhesive Backing Removed



Battery

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT205332: About AppleCare service certifications](#).

For video instruction, refer to article [SV183: Battery Replacement Video](#).

Remove:

- [Bottom Case](#)

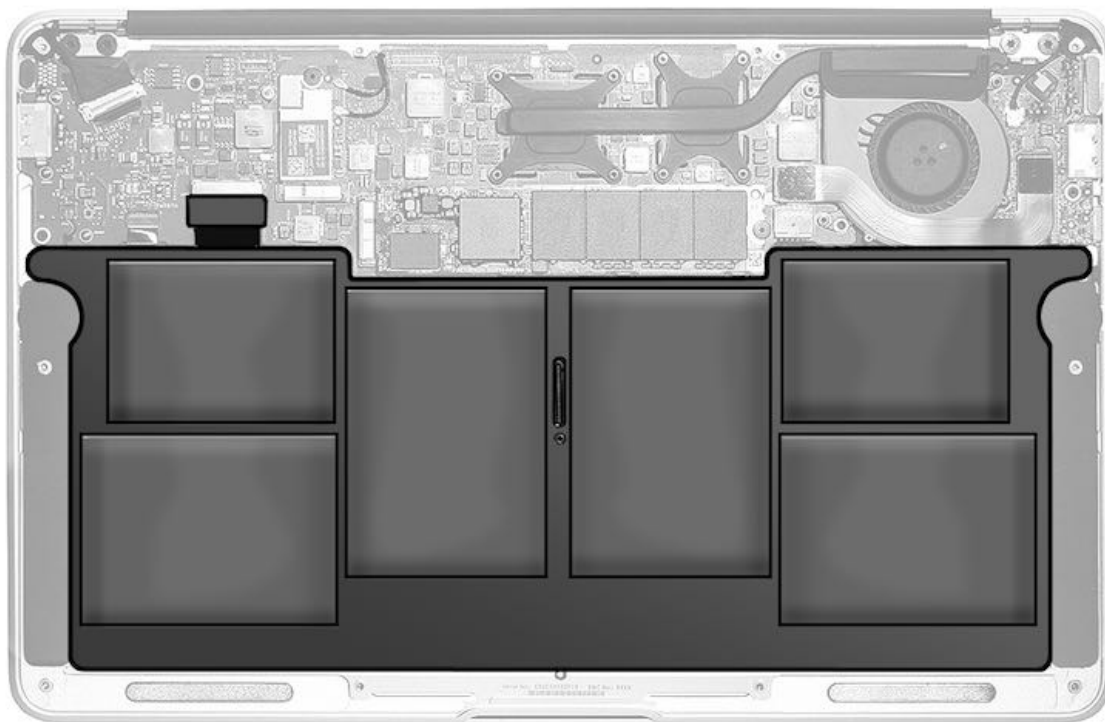


Important: Immediately after removing the bottom case, always attach the battery cover and disconnect the battery cable from the logic board.

Caution: Read [Battery Safety Precautions](#) before beginning this procedure.

Note: Batteries look alike for all models except for the location of the battery connector.

Late 2010



Mid 2011 and Mid 2012

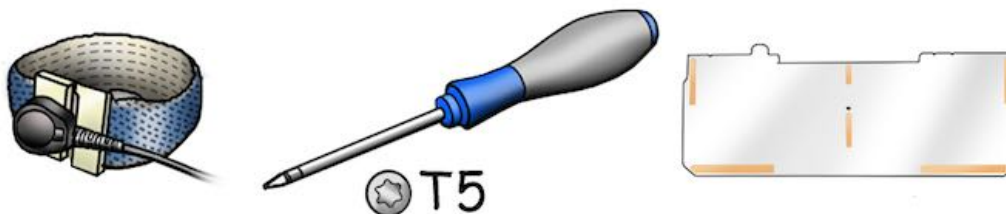


Mid 2013, Early 2014, and Early 2015



Tools

- ESD wrist strap
- Torx T5 screwdriver (magnetized)
- Protective battery cover, 922-9736 or 076-1372 (kit)
- Torque driver, optional (not shown)



Steps For Removal

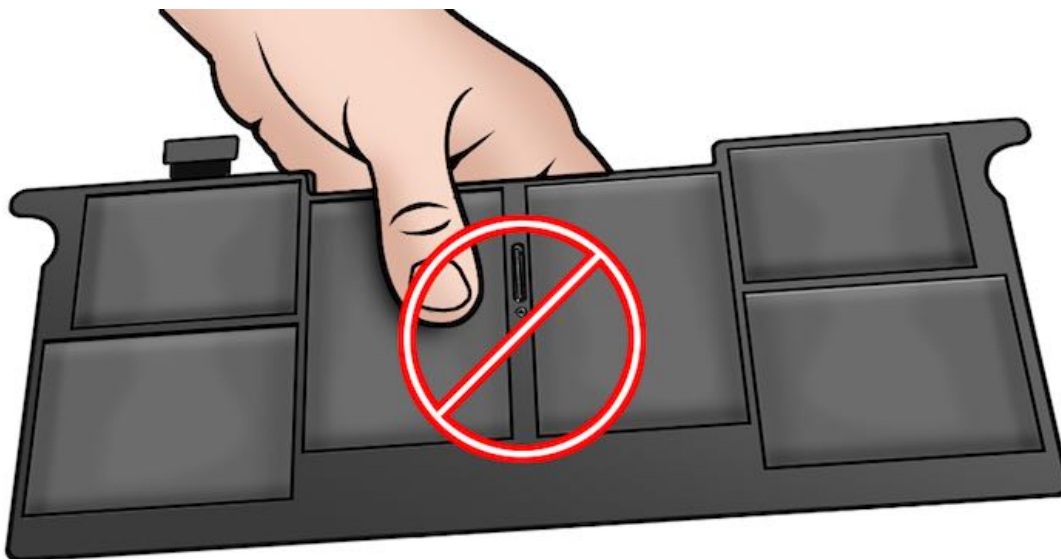


Warning: The battery contains several soft battery packs. Always attach the battery cover immediately after removing the bottom case, before beginning battery removal.



Important:

- Keep battery cover on battery at all times when battery is out of the computer.
- Handle battery with utmost care.
- Hold battery by edges only, with two hands at all times.
- Do not drop, stack, puncture, press, squeeze, crush, flex, twist, torque, or apply unnecessary pressure to a battery, as this may result in damage.
- If setting battery aside, make sure surface is clean—free of dust, dirt, screws, and other debris.
- If battery is dropped, replace it even if no damage is visible.



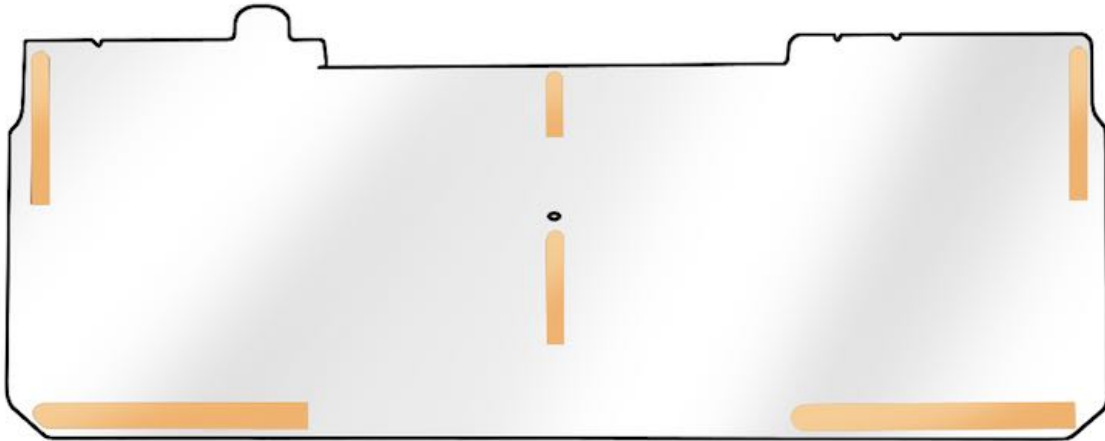
1. With battery installed in computer, remove adhesive strips from clean battery cover.



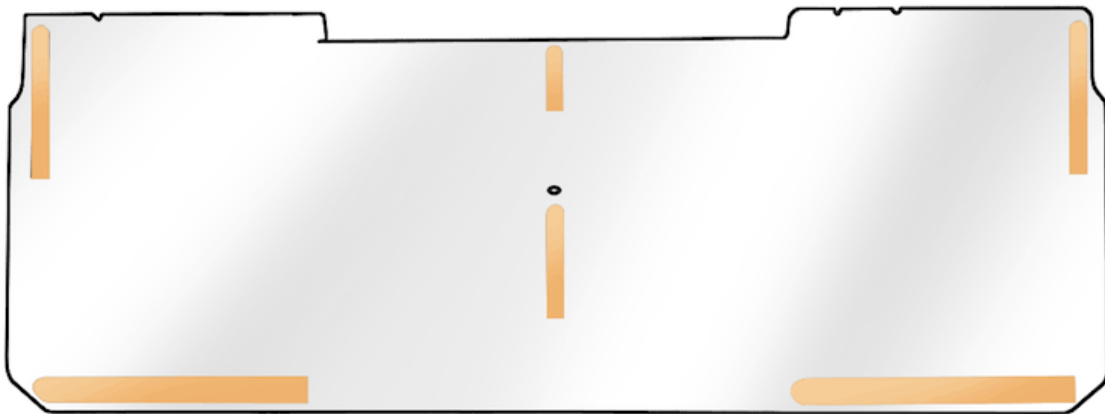
Warning: Do not perform this procedure without a clean battery cover.

Note: Two battery cover versions exist—one with a rounded tab at the top, and one without. The one without the tab is easier to use on the Mid 2011 and later models because it does not cover the battery connector. However, both cover versions can be used for any 11-inch model.

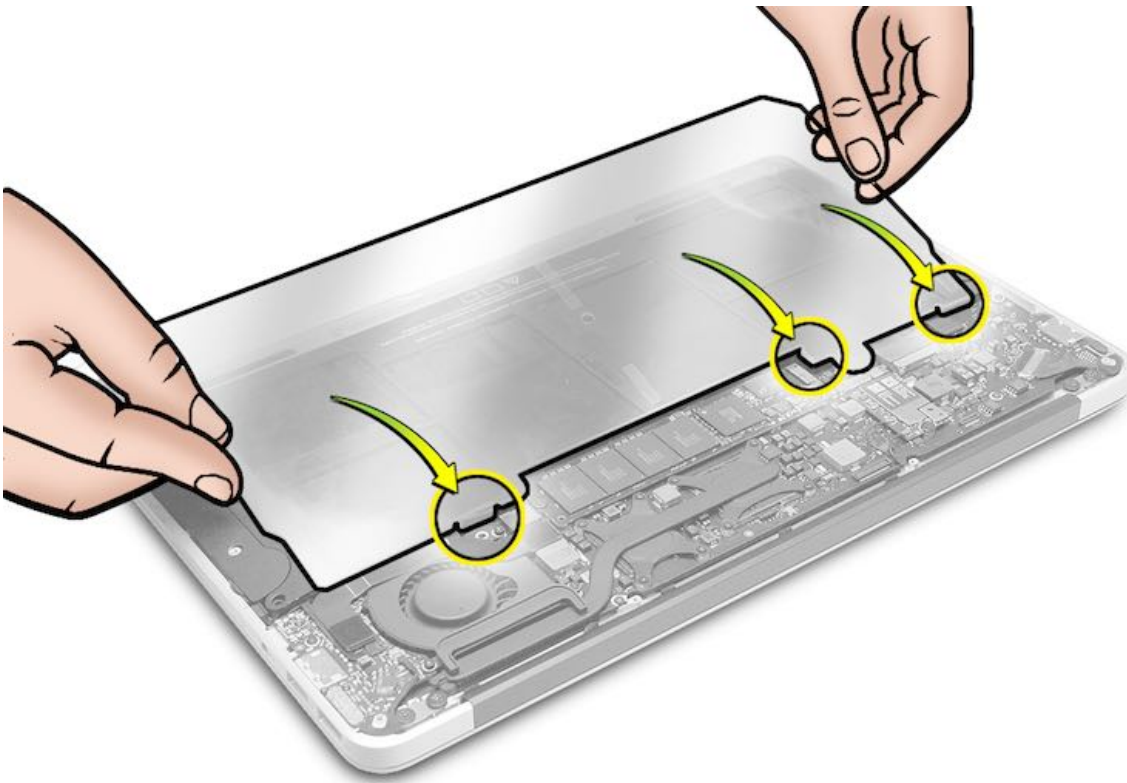
Late 2010



Mid 2011, Mid 2012, Mid 2013, Early 2014, Early 2015

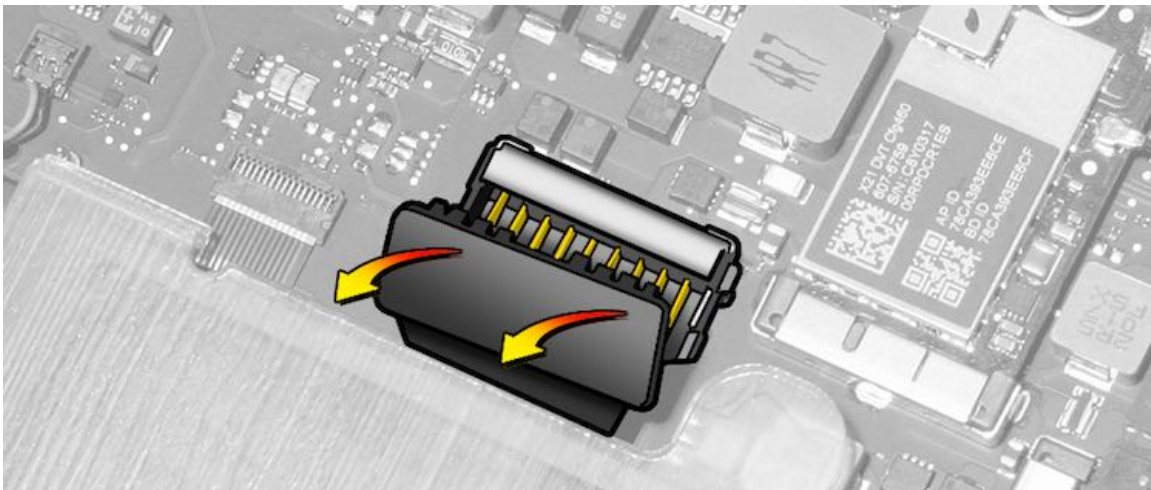


2. Using hooks at top of battery cover, tilt cover onto battery.
3. Gently secure cover by running your finger over parts of cover that have adhesive.



4. Pull battery connector straight up from logic board.

Important: Disconnect battery connector whenever performing repairs. You do not need to remove battery unless it blocks module being repaired.



5. Keeping screwdriver perpendicular to avoid battery damage, remove five Torx T5 screws:

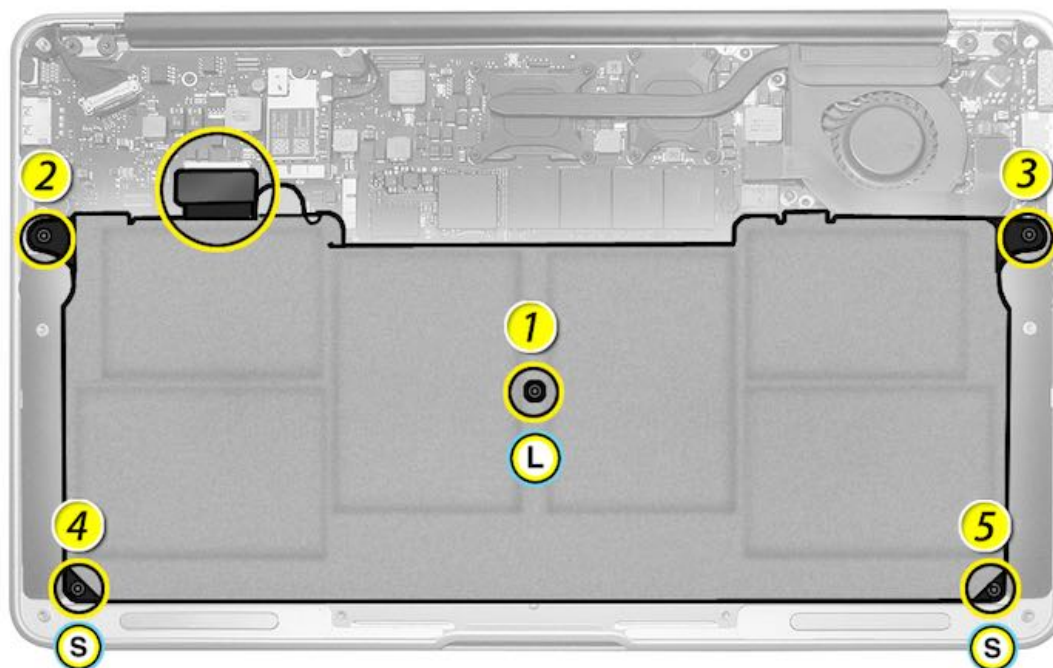
Two 922-9689 (5.16 mm), rear



Two 922-9690 (2.62 mm), front (in image, S = Short)



One 922-9693 (6.02 mm), center (in image, L = Long)



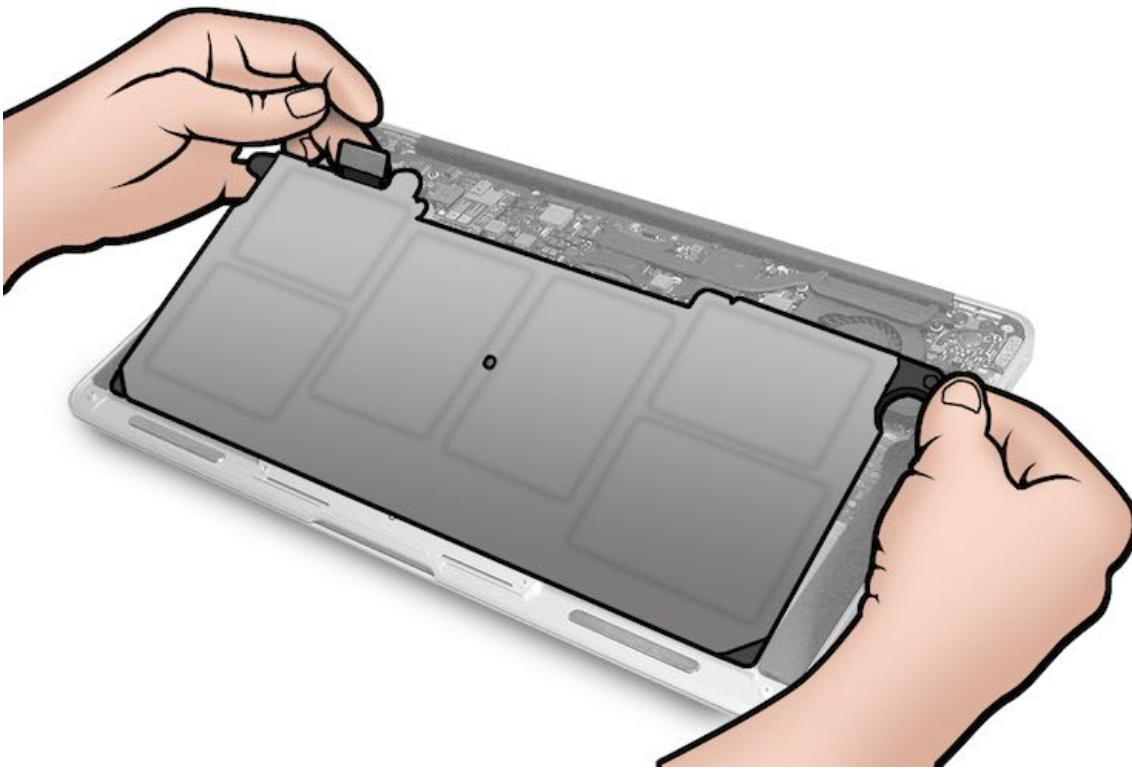
6. Using battery cable, tilt covered battery out of system.



Important: Handle battery by edges.

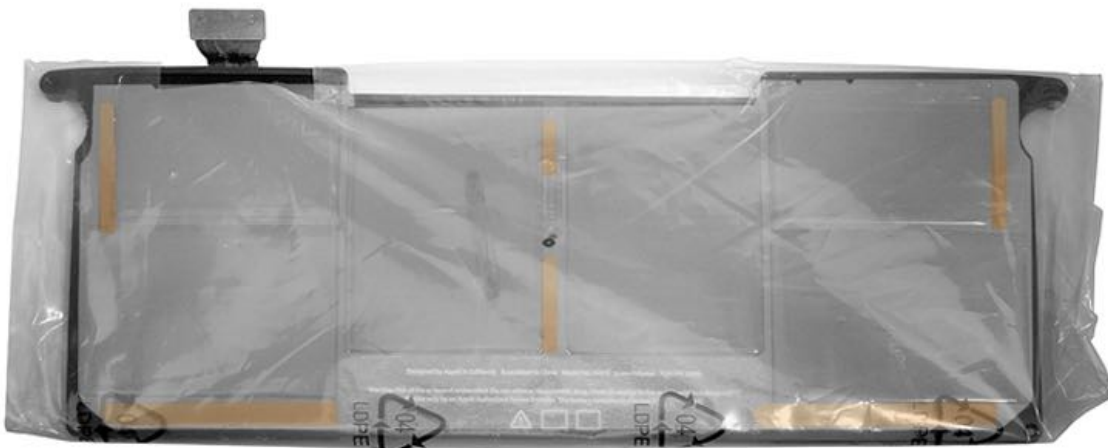
7. Place covered battery (with cover up) on a clean surface (free of dust, dirt, screws, and other debris).

8. If packaging battery for return, keep battery cover installed.



Steps For Reassembly

1. If installing new battery, unwrap it and make sure it has a battery cover. If it does not have a cover, do NOT use it. Contact TCS for further directions.

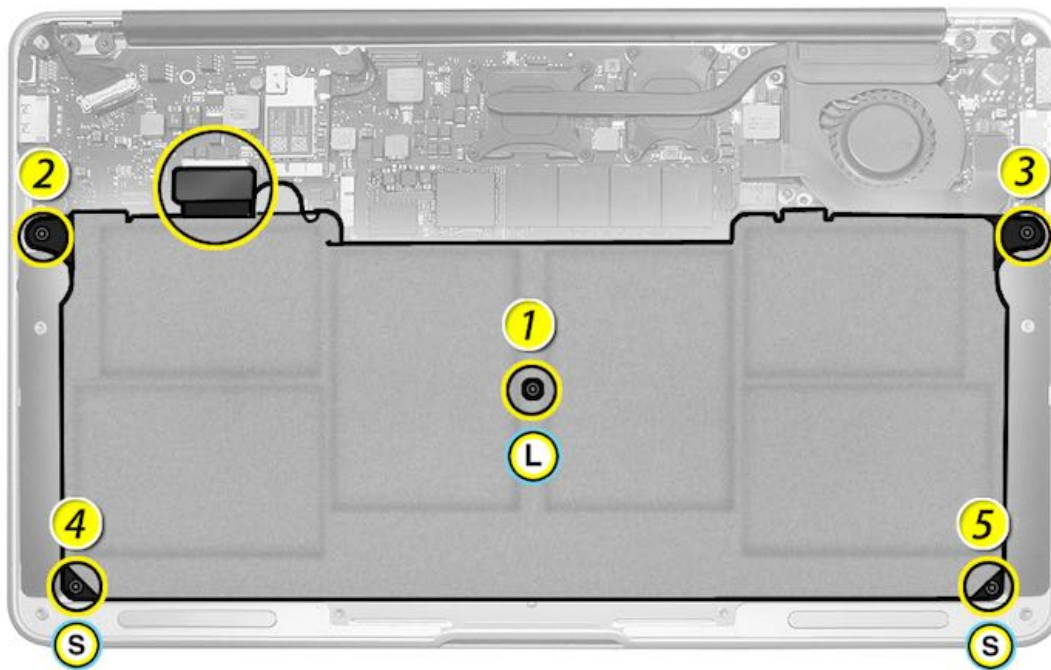


2. Before installing battery, check that top case is clean—free of screws or other foreign material in battery area.

3. Use two hands to place covered battery into open top case.

4. Install five screws in order shown (longest screw at center, shortest screws in front). **Note:** Use a torque driver, if available, to tighten screws to 1.8 ± 0.18 Kgf-cm. If no torque driver is available, install screws finger tight.

Important: Handle screwdriver perpendicular to battery cover to prevent damage to battery.



5. If performing other repairs, be sure to leave battery cable disconnected. Otherwise, connect battery cable to logic board.

6. Before installing bottom case, peel off battery cover using rounded tab at top if present.

Note: A clean battery cover can be reused if it is free of dust, dirt, and other debris.

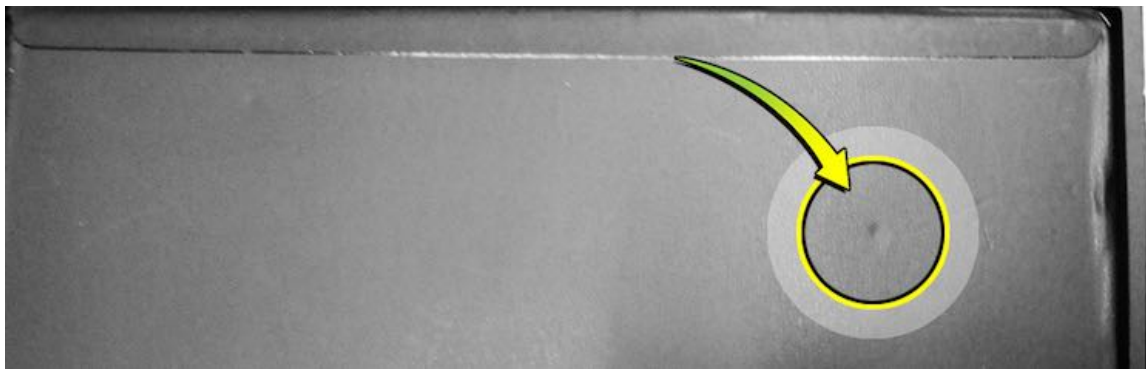
7. Visually evaluate battery for damage.



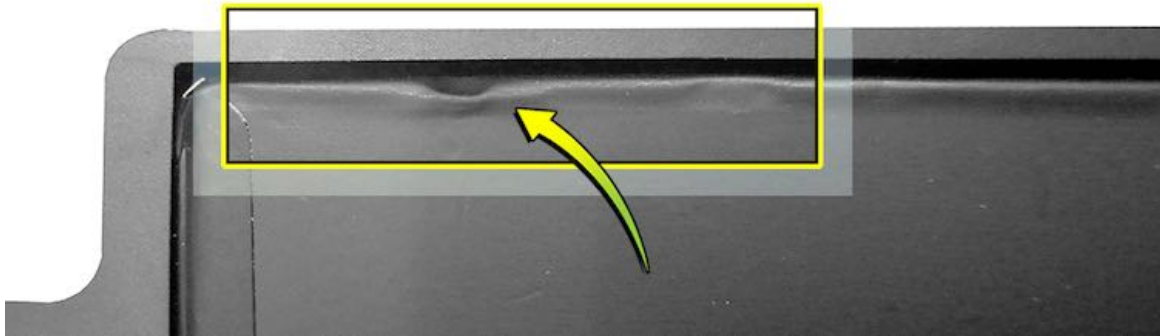
Evaluating Battery Damage

Use battery if:

- Minor dents (up to eight dents if 0.4 mm deep or less; up to five dents if 1.5 mm deep or less; up to three dents if 2.0 mm deep or less)

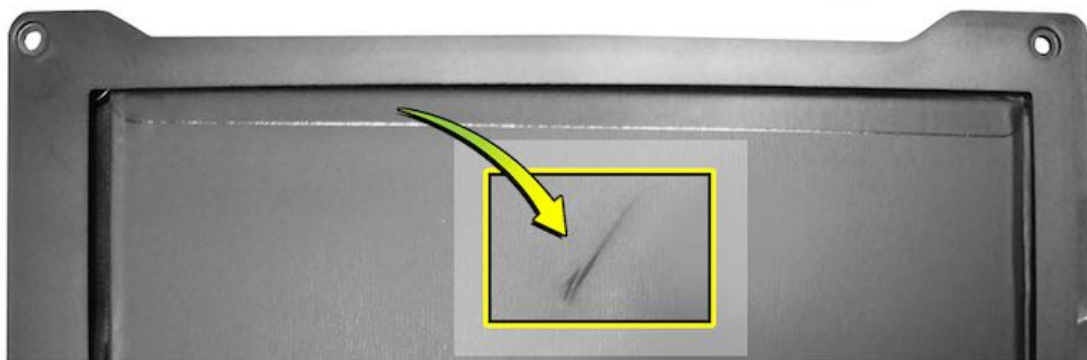


- Minor cell pack deformity (up to 2.0 mm total area)

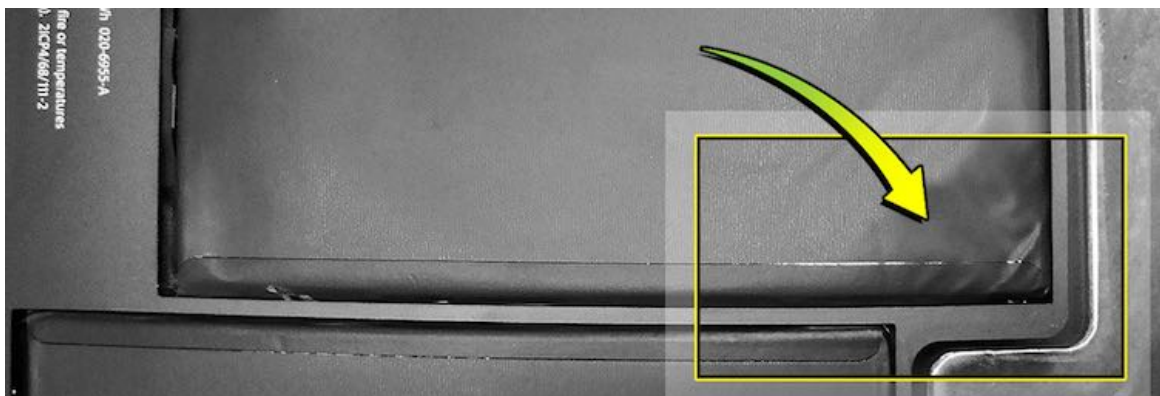


Return battery if:

- Scratches



- Swollen or wrinkled cell pack



Packing the Battery

IMPORTANT: Do not discard battery packaging!

Both the inner and outer cardboard boxes used to ship a KGB battery must be used when returning a KBB battery. Follow the packing procedure below.

If either box has been damaged or lost, order a replacement service package. The service package includes both the inner and outer cardboard boxes and an ESD bag. Reuse the battery cover that was included with the KGB battery or, if a new cover is needed, order 922-9736.

Part Number	Description
606-0090	SVC, PKG, BATTERY, MB AIR 13-INCH
606-0091	SVC, PKG, BATTERY, MB AIR 11-INCH

1. Place protective cover on battery.



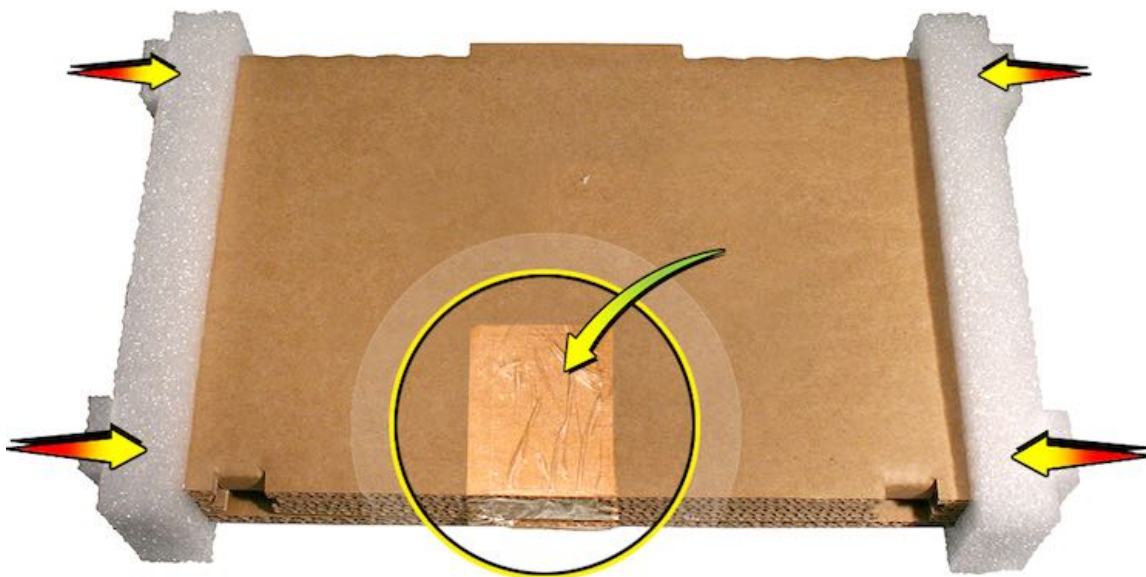
2. Place covered battery inside ESD bag.



3. Carefully place covered and wrapped battery in cardboard packing material.



4. Close inner box. Attach foam end pieces on box and tape the box closed. **Note:** The packing **MUST** be taped closed. Any tape will work.



5. Carefully place taped box into shipping box.

6. Close box and return battery using normal shipping procedures. **Note:** Do not staple anything to the box; it could puncture the battery.

Note: As with shipping any battery, IATA compliance is a must. See article [HT204643: Prepare lithium batteries and devices](#)

[powered by lithium batteries for shipping.](#)



Right Speaker

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT202594: Exams for Service Technicians](#).

For video instruction, refer to article [SV184: Right Speaker Replacement Video](#).

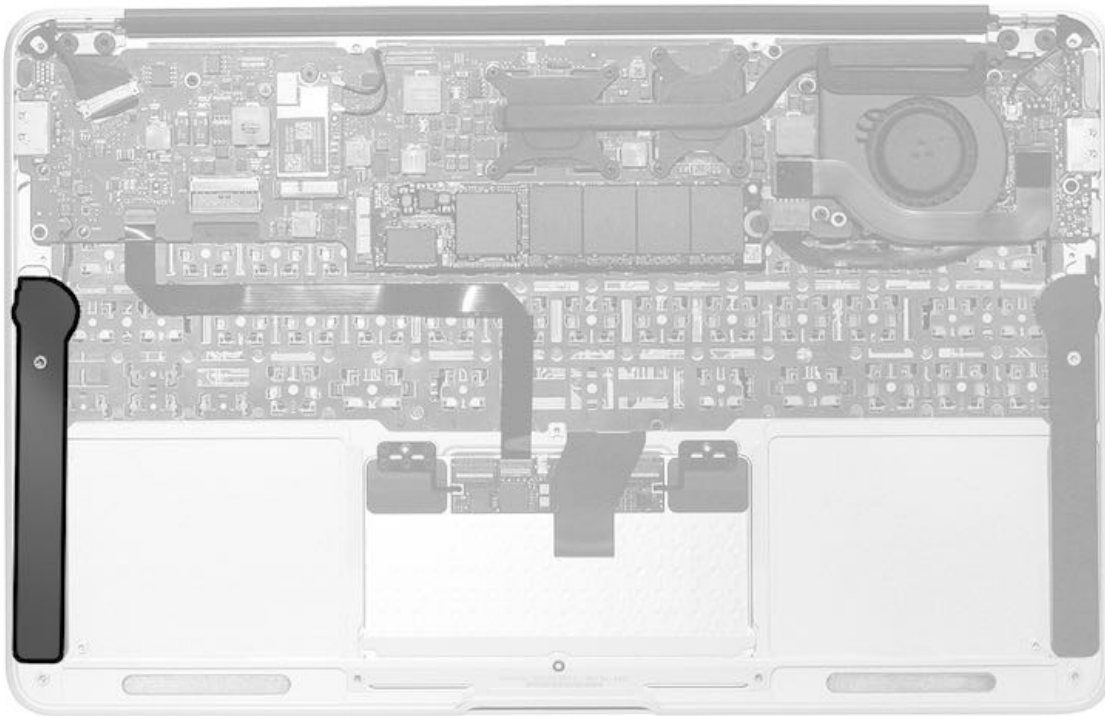
Remove:

- [Bottom Case](#)
- [Battery](#)



Important: Immediately after removing the bottom case, always attach the battery cover and disconnect the battery cable from the logic board.

Caution: Read [Battery Safety Precautions](#) before beginning this procedure.



Tools

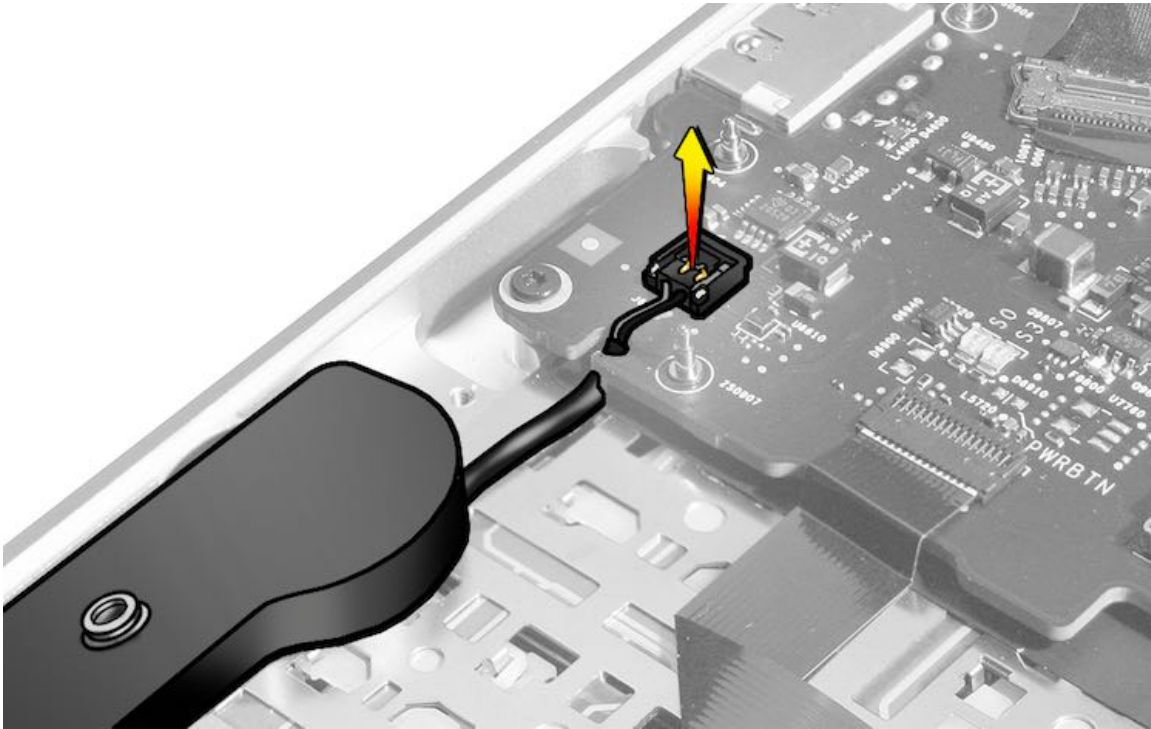
- ESD wrist strap
- Black stick



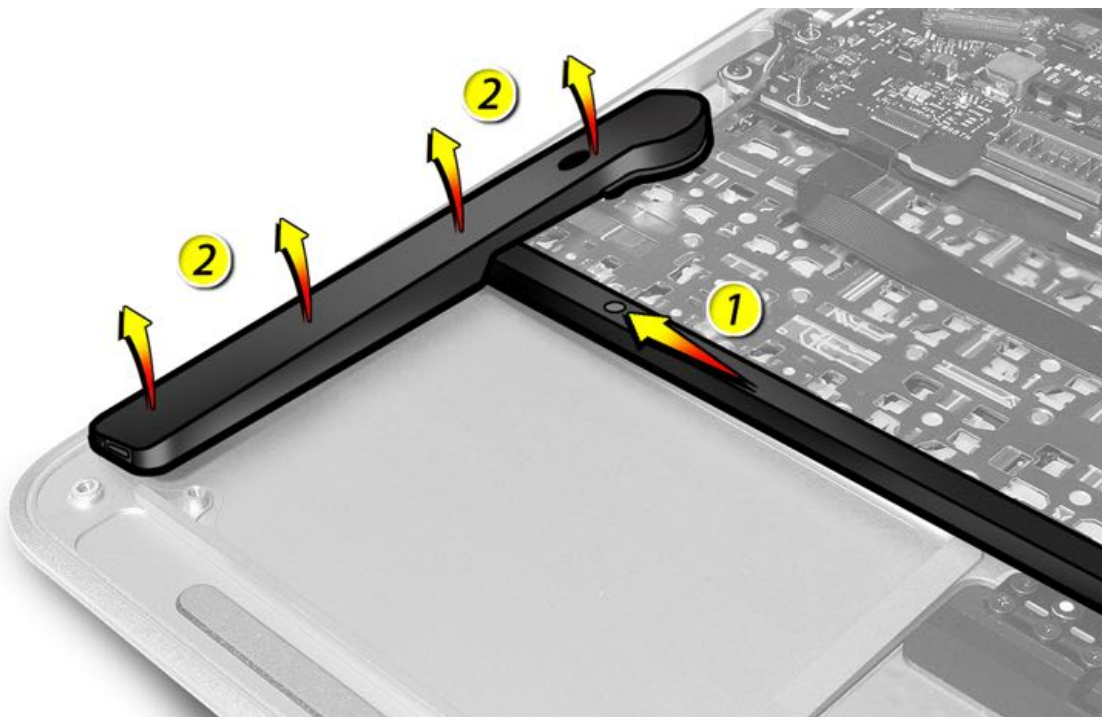
Steps For Removal

1. Use a black stick to disconnect the vertical insertion speaker cable from the logic board.

2. Unroute the speaker cable from notch in the logic board.



3. Use a black stick to pry very high bond (VHB) adhesive securing the speaker to the top case.

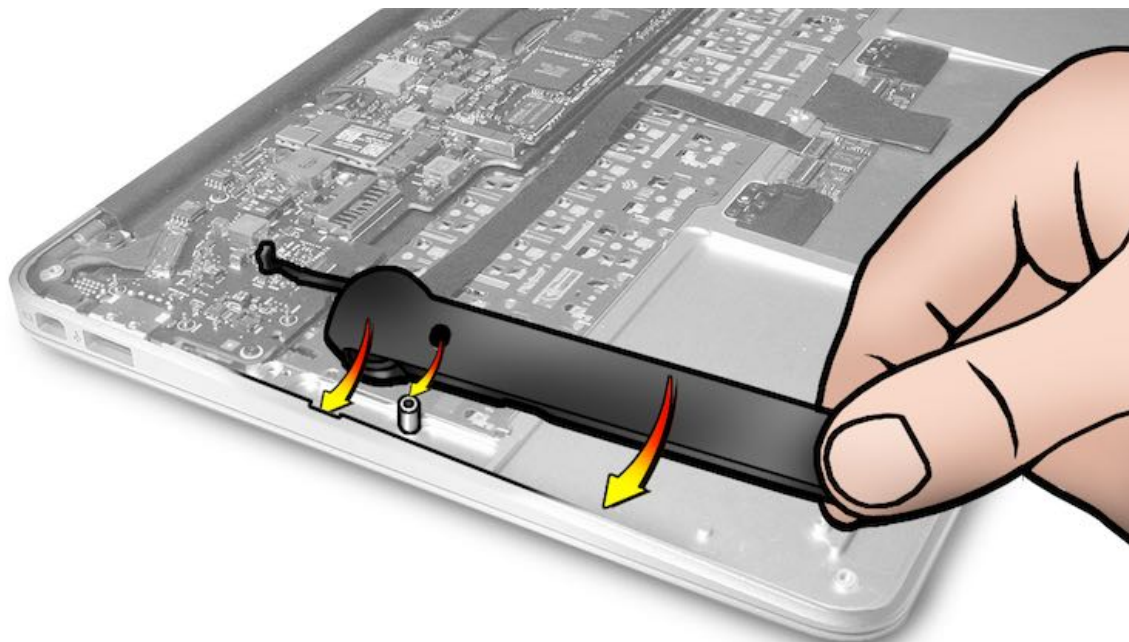


Steps For Reassembly

Note: For the Early 2015 model, replacement speakers come as a pair.

1. If installing a new speaker, make sure top case is clean and free of any residual adhesive or debris. **Important:** Use only the adhesive preinstalled on the new speaker. **The adhesive must lie flat in a single layer.** Do not double up speaker/top case adhesive.
2. Peel adhesive backing from new speaker body, and tilt over guidepost and into top case.
3. Press speaker into top case so that VHB adheres completely.
4. Route cable into notch on logic board.
5. Secure cable connector to logic board.

Important: If installing a new or existing speaker in a new Mid 2013, Early 2014, or Early 2015 top case, it is recommended to use the Trackpad Keyboard Mapper. For more information, refer to article [TP1016: AST Reference Guide: Using the Trackpad Keyboard Mapper](#).



Left Speaker

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT202594: Exams for Service Technicians](#).

For video instruction, refer to article [SV185: Left Speaker Replacement Video](#).

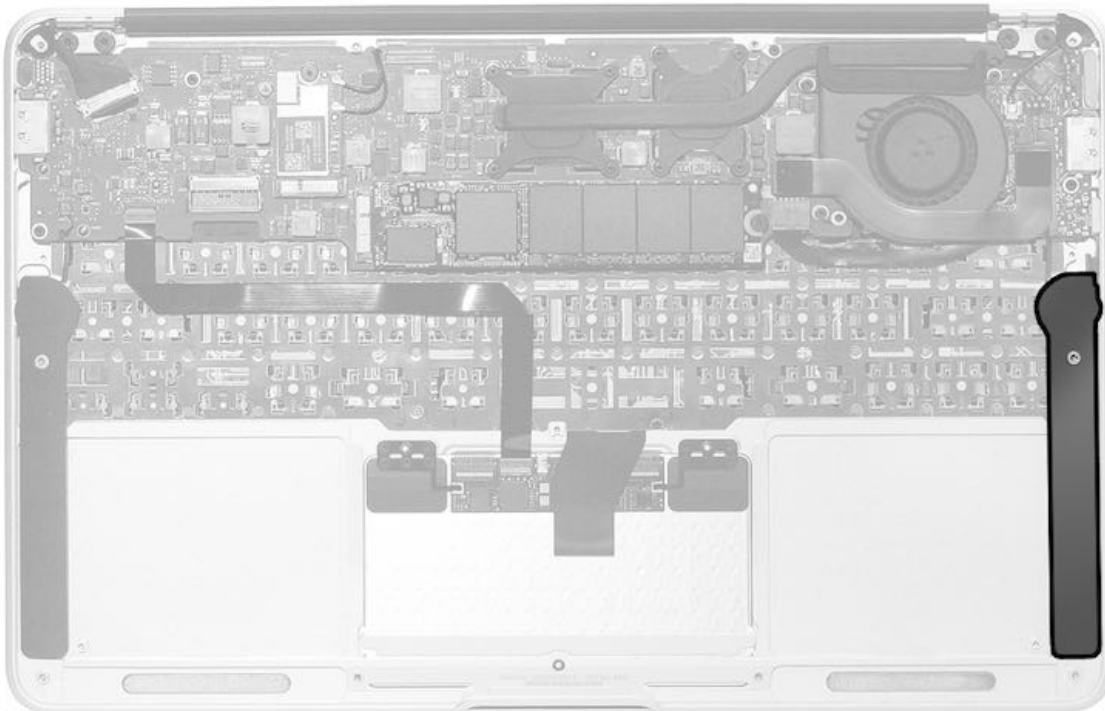
Remove:

- [Bottom Case](#)
- [Battery](#)
- [Input/Output \(I/O\) Flex Cable](#)



Important: Immediately after removing the bottom case, always attach the battery cover and disconnect the battery cable from the logic board.

Caution: Read [Battery Safety Precautions](#) before beginning this procedure.



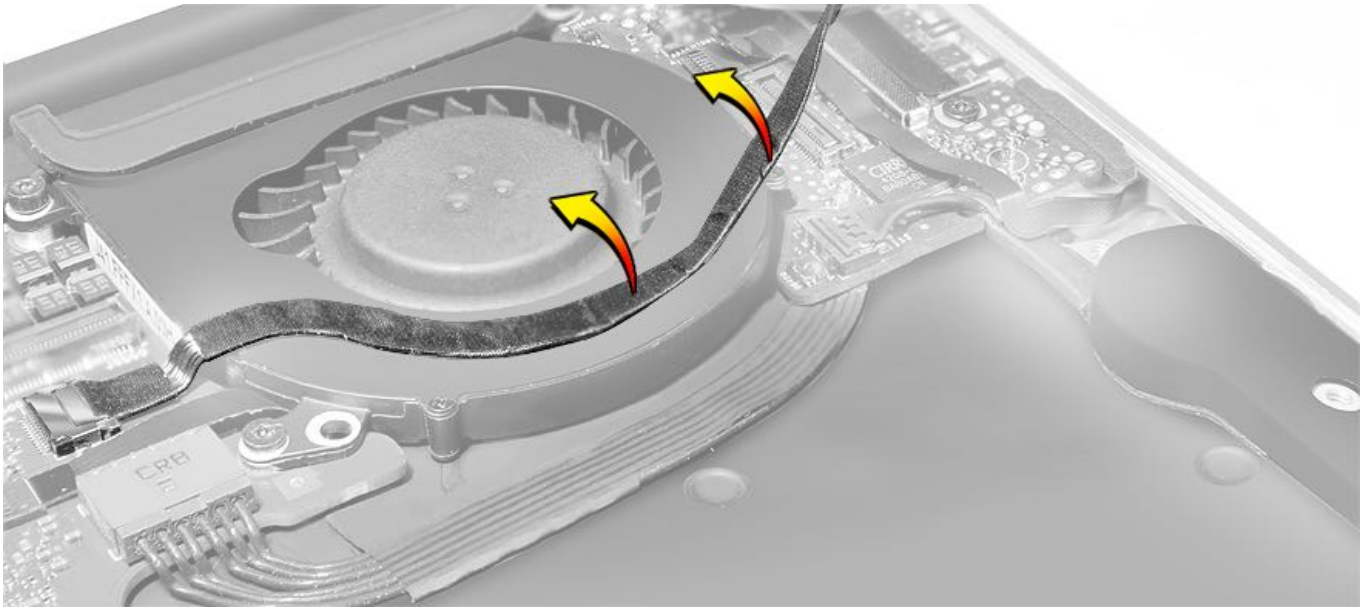
Tools

- ESD wrist strap
- Black stick



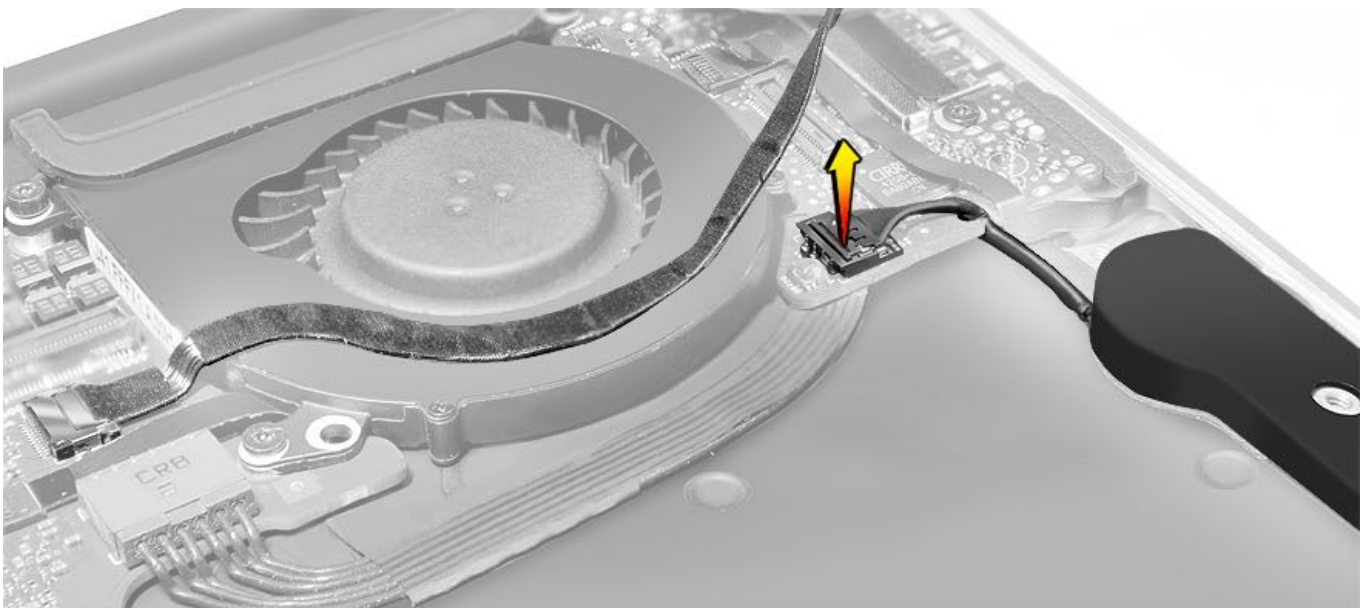
Steps For Removal

1. For **Mid 2013, Early 2014, and Early 2015 models**, lift up, but do not disconnect, the camera cable in order to access the speaker cable.

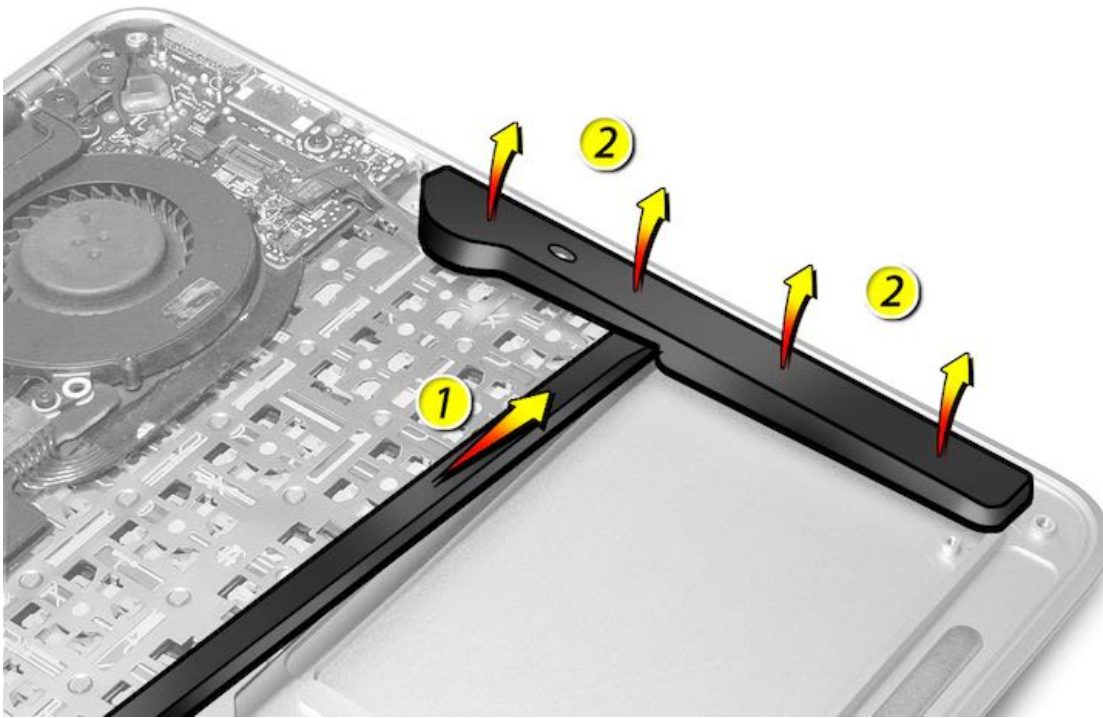


2. Use a black stick to disconnect the vertical insertion speaker cable from the I/O board.

3. Unroute the speaker cable from notch in the I/O board.



4. Use a black stick to pry very high bond (VHB) adhesive securing the speaker to the top case.

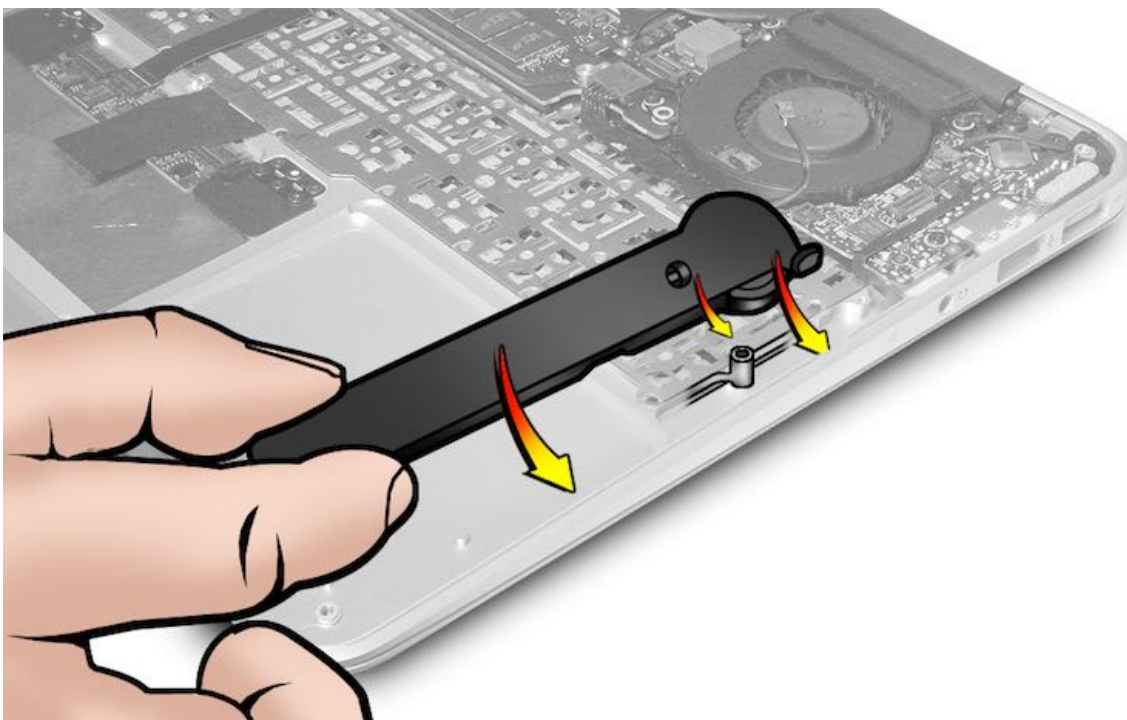


Steps For Reassembly

Note: For the Early 2015 model, replacement speakers come as a pair.

1. If installing a new speaker, make sure top case is clean and free of any residual adhesive or debris. **Important:** Use only the adhesive preinstalled on the new speaker. **The adhesive must lie flat in a single layer.** Do not double up speaker/top case adhesive.
2. Peel adhesive backing from new speaker body, and tilt over guidepost and into top case.
3. Press speaker into case so that VHB adheres completely.
4. Route cable into notch on I/O board.
5. Secure cable connector to I/O board.

Important: If installing a new or existing speaker in a new Mid 2013, Early 2014, or Early 2015 top case, it is recommended to use the Trackpad Keyboard Mapper. For more information, refer to article [TP1016: AST Reference Guide: Using the Trackpad Keyboard Mapper](#).



Solid-State Drive (SSD) Card or Flash Storage

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT202594: Exams for Service Technicians](#).

For video instruction, refer to articles [SV194: Flash Storage Replacement Video](#) (Mid 2012) and [SV176: Flash Storage Replacement Video](#) (Mid 2013, Early 2014, and Early 2015).

Remove:

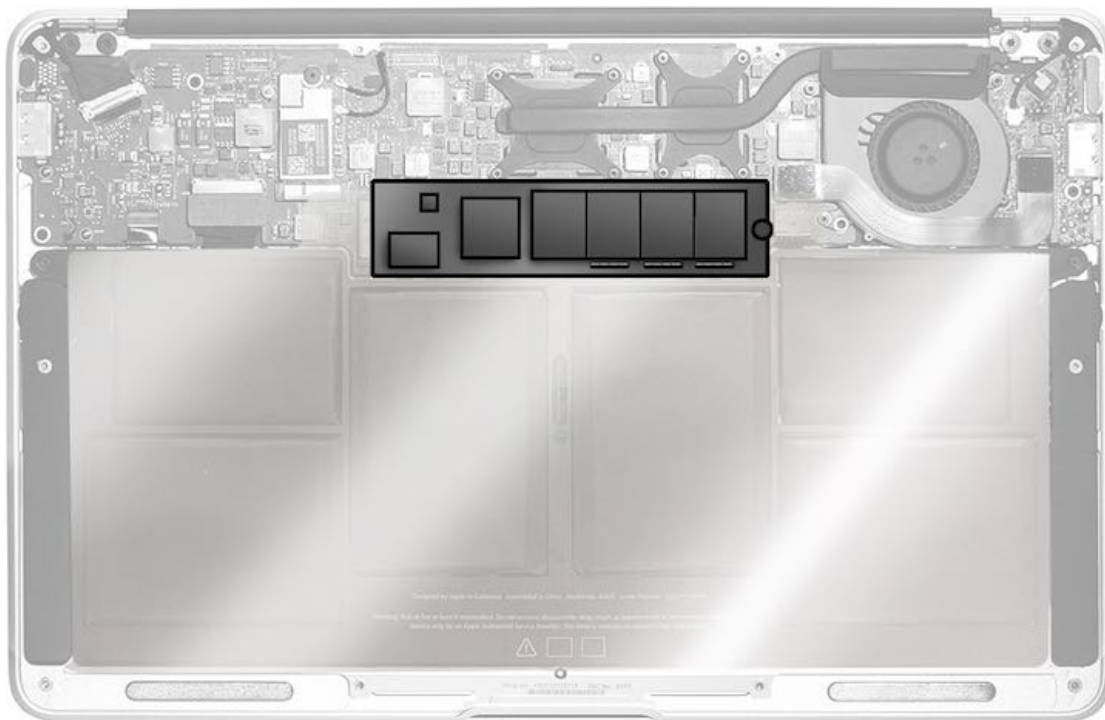
- [Bottom Case](#)



Important: Immediately after removing the bottom case, always attach the battery cover and disconnect the battery cable from the logic board.

Caution: Read [Battery Safety Precautions](#) before beginning this procedure.

Caution: Make sure data is backed up before removing SSD card or flash storage.



Tools

- ESD wrist strap
- Torx #5 screwdriver, magnetized



Steps For Removal

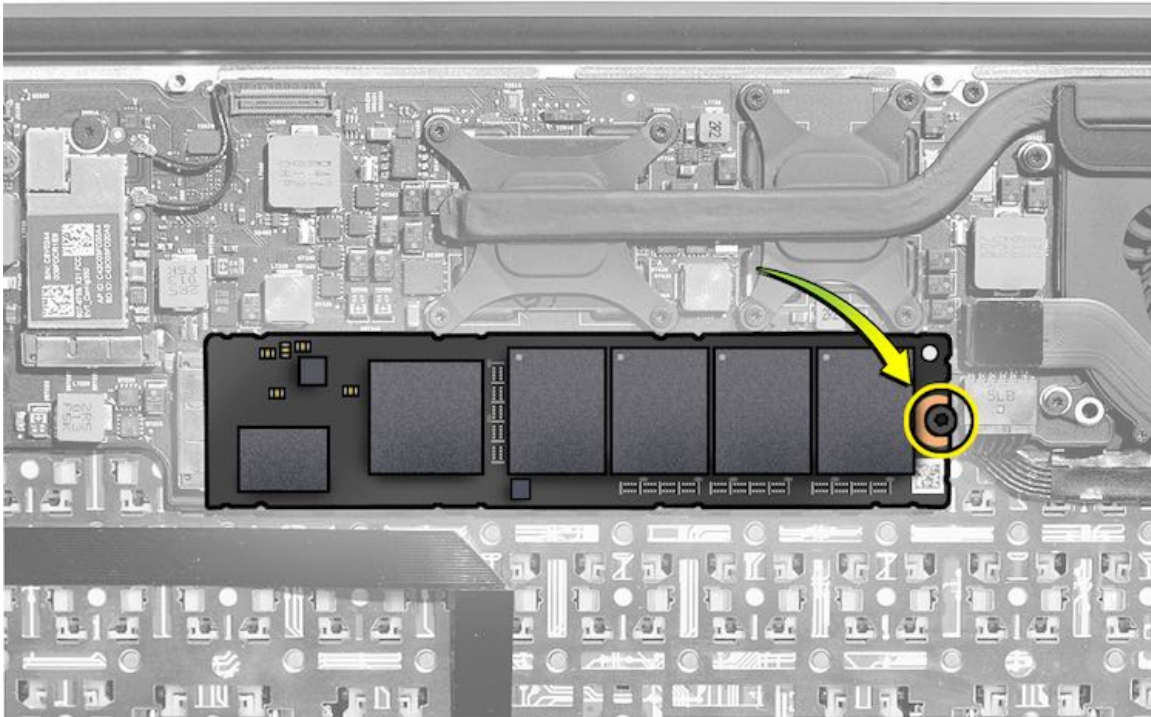
1. Remove Torx T5 screw:

- 922-9651 (2.85 mm)



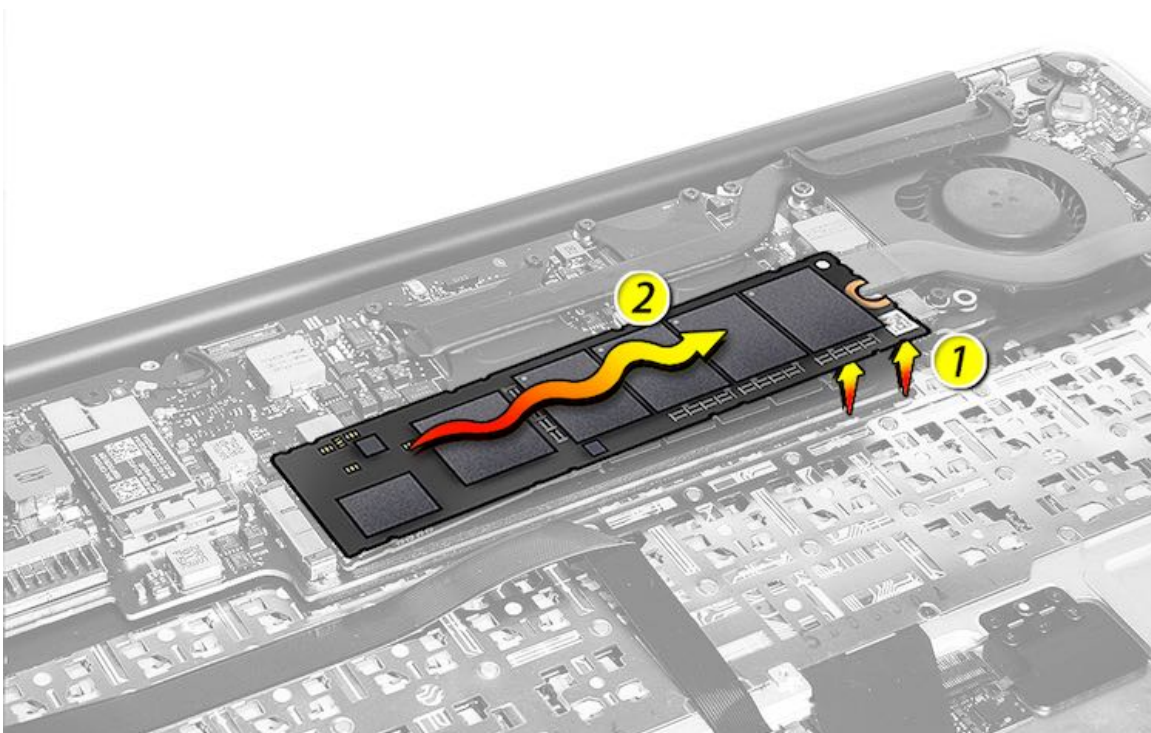
Caution: Follow safe handling:

- Hold card by edges.
- Do not touch gold connectors.
- Do not touch circuitry.



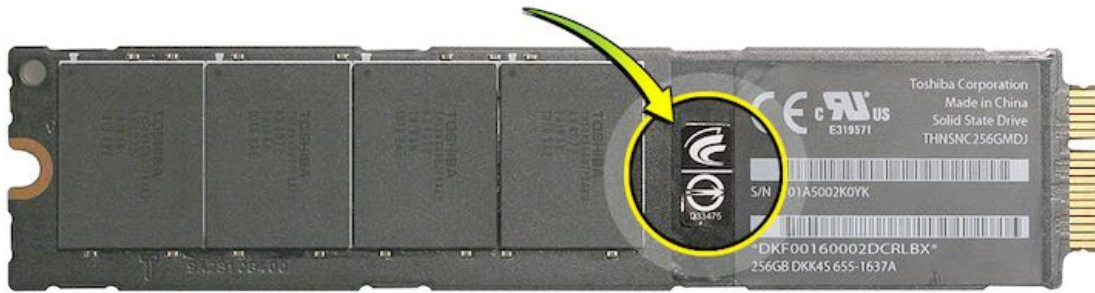
2. Tilt up card at a slight angle—just enough to hold it. Gently rock card while pulling it to disconnect from logic board. Keep it close and parallel to logic board.

Reassembly Note: Push card securely into slot, confirming that it is seated properly.



Steps For Reassembly

Replacement Note: Before installing a new SSD card or flash storage into the computer, peel off and discard the import compliance label, if present. This label is required to import the service part into certain countries, but is no longer relevant once the part is installed into a computer.



Reinstalling Software That Came with the Computer

Reinstalling Software That Came with the Computer

This procedure requires an Internet connection.

Note: In some situations, a user may have set a firmware password. The user must know the firmware password in order to reinstall OS X or macOS. If the user cannot remember the password, then refer to the technician instructions in article [HT204455: How to set a firmware password on your Mac](#).

Important: Apple recommends that users back up their data before any software restore procedure. Back up essential files before installing OS X or macOS. Apple is not responsible for any loss of data. For instructions on using Time Machine, refer to article [HT201250: How to use Time Machine to back up or restore your Mac](#).

For instructions on reinstalling the OS, follow the steps in article [HT204904: How to reinstall macOS](#).

For more information about recovery mode, refer to article [HT201314: About macOS Recovery](#).

AirPort/Bluetooth Card or Wireless Card

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT202594: Exams for Service Technicians](#).

For video instruction, refer to articles [SV195: Wireless Card Replacement Video](#) (Mid 2012) or [SV177: Wireless Card Replacement Video](#) (Mid 2013, Early 2014, and Early 2015).

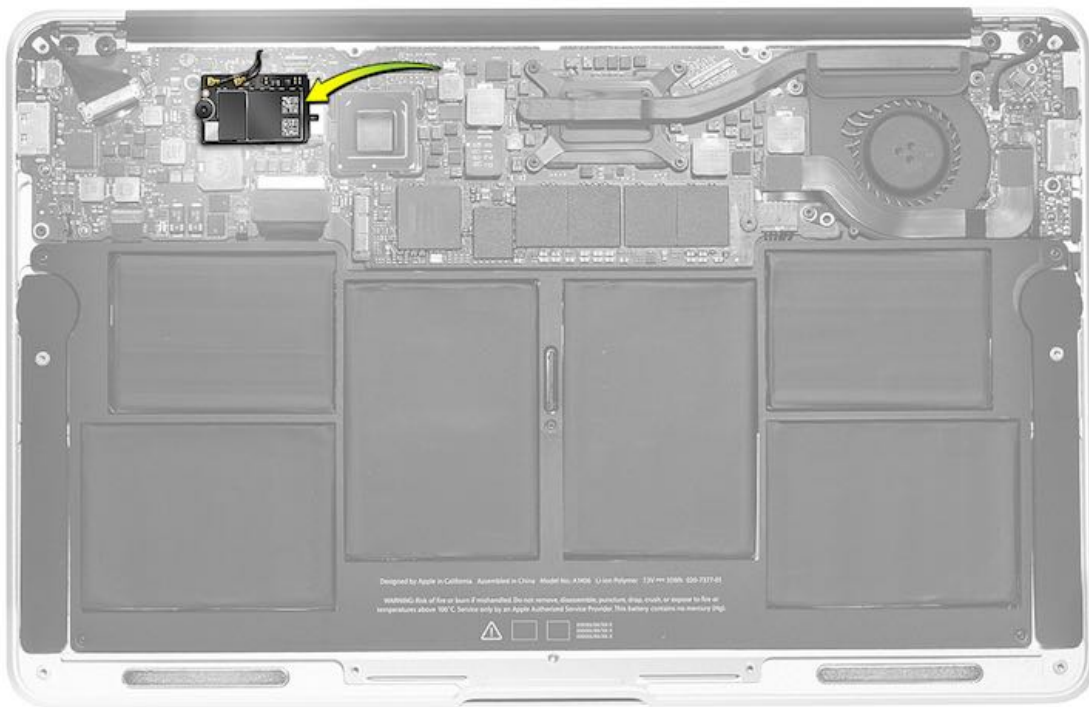
Remove:

- [Bottom Case](#)



Important: Immediately after removing the bottom case, always attach the battery cover and disconnect the battery cable from the logic board.

Caution: Read [Battery Safety Precautions](#) before beginning this procedure.



Tools

- ESD wrist strap
- ESD-safe tweezers
- Torx T5 screwdriver, magnetized



Steps For Removal

Caution: Avoid stressing antenna cables when disconnecting them.

1. Orient case so clutch cover faces you.

2. Using ESD-safe tweezers, carefully grip antenna cable on metal extension behind connector head and gently pull cable straight up and off card.

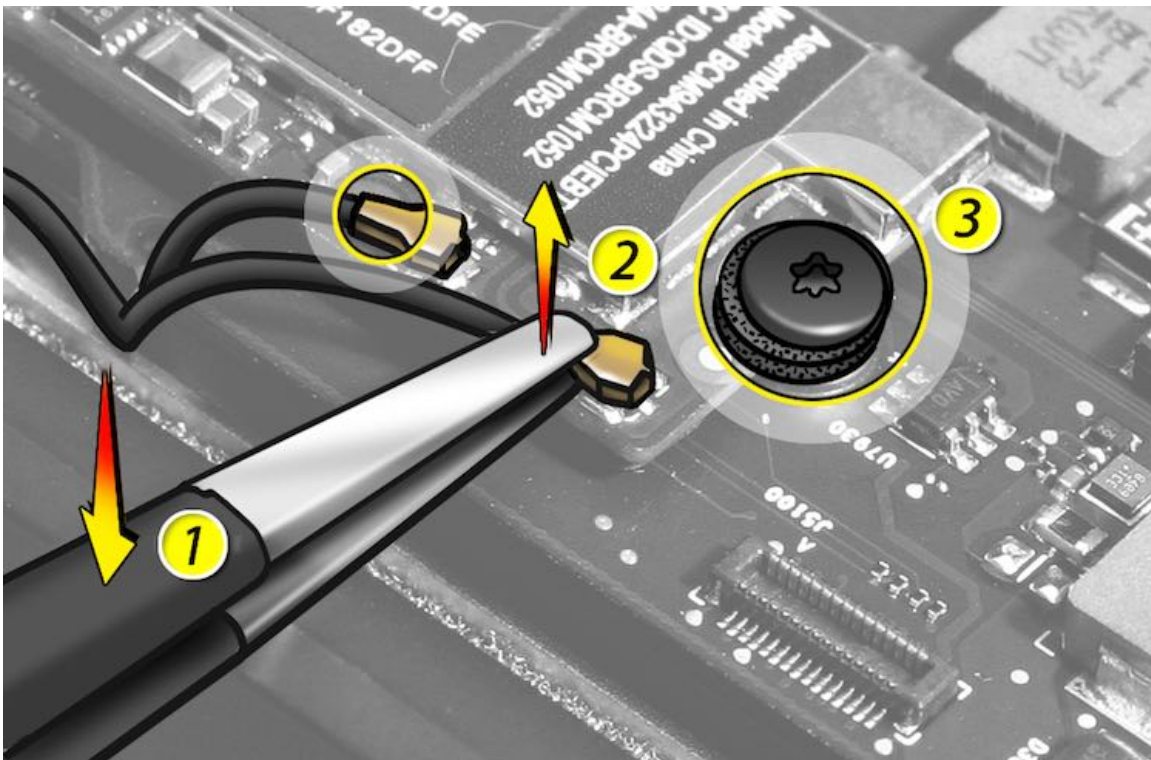
Note: If cable has not been previously disconnected, you may have to apply additional force.

3. Remove Torx T5 screw:

- 922-9651 (Mid 2012, Mid 2013, Early 2014, Early 2015)



- 923-0025 (Mid 2011)



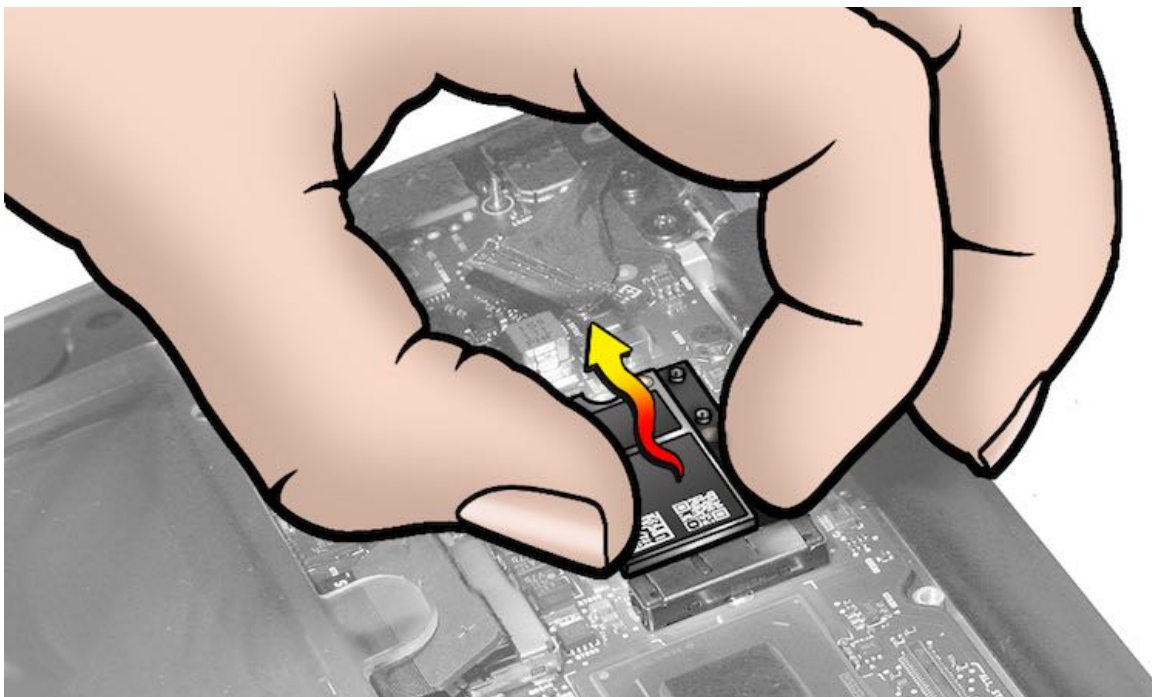
Mid 2013, Early 2014, and Early 2015



4. **Without lifting card**, rock and pull card to disconnect it from logic board connector. Keep it close and parallel to logic board.

Caution: Follow safe handling:

- Hold card by edges.
- Do not touch gold connectors.
- Do not touch circuitry.

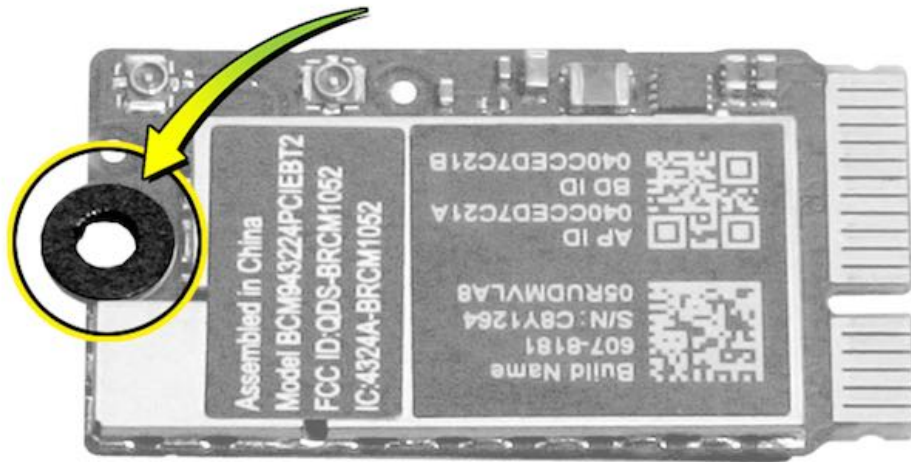


Steps For Reassembly

1. **Mid 2011 model:** If you are installing a **new** card, discard old screw, make sure ring is attached to card, and use the 922-9651 screw included in card kit.



Note: Early production units did not include ring. If you are transferring the **same** card and ring is not present, use existing screw and no ring.



Mid 2012

Note: Visible differences on the Mid 2012 AirPort/Bluetooth card are:

- Card does not use ring (shown above)
- Back side of card is covered with EMI tape

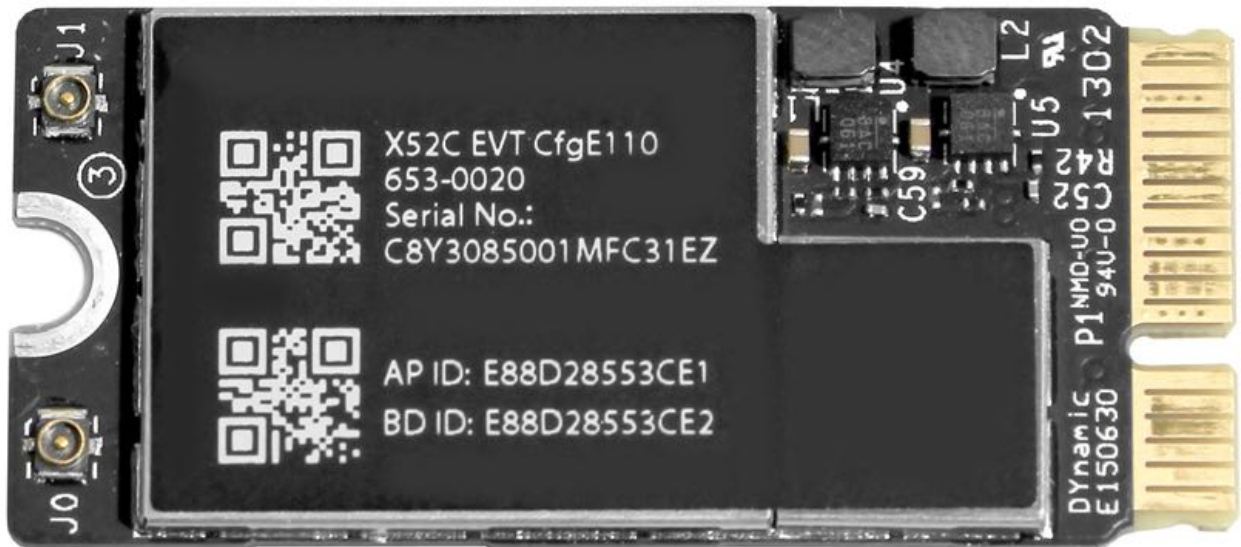


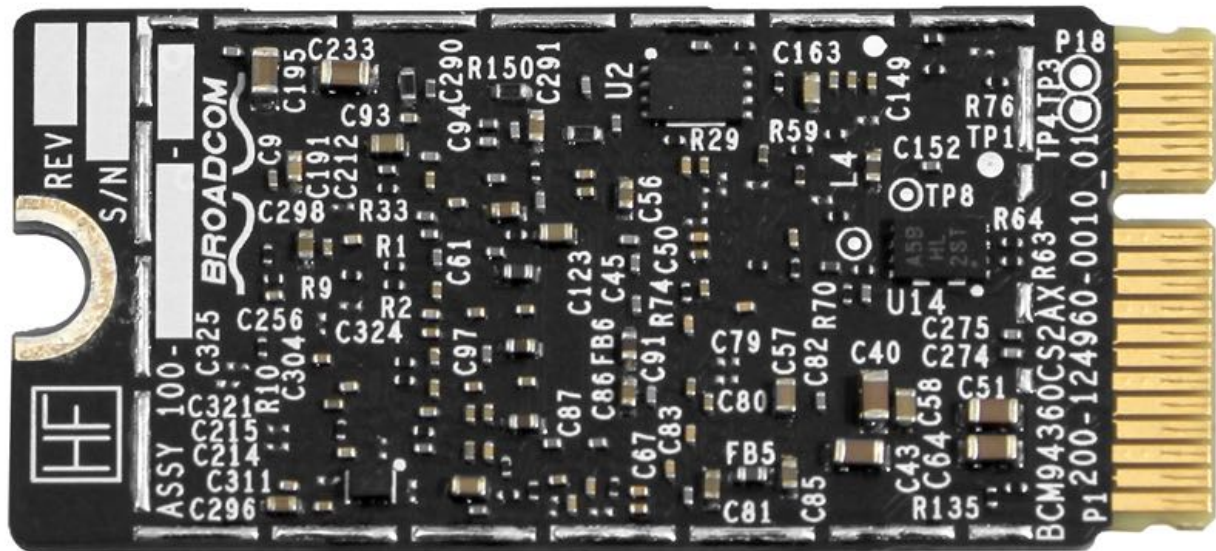


Mid 2013, Early 2014, and Early 2015

Note: Visible differences on the Mid 2013, Early 2014, and Early 2015 wireless card:

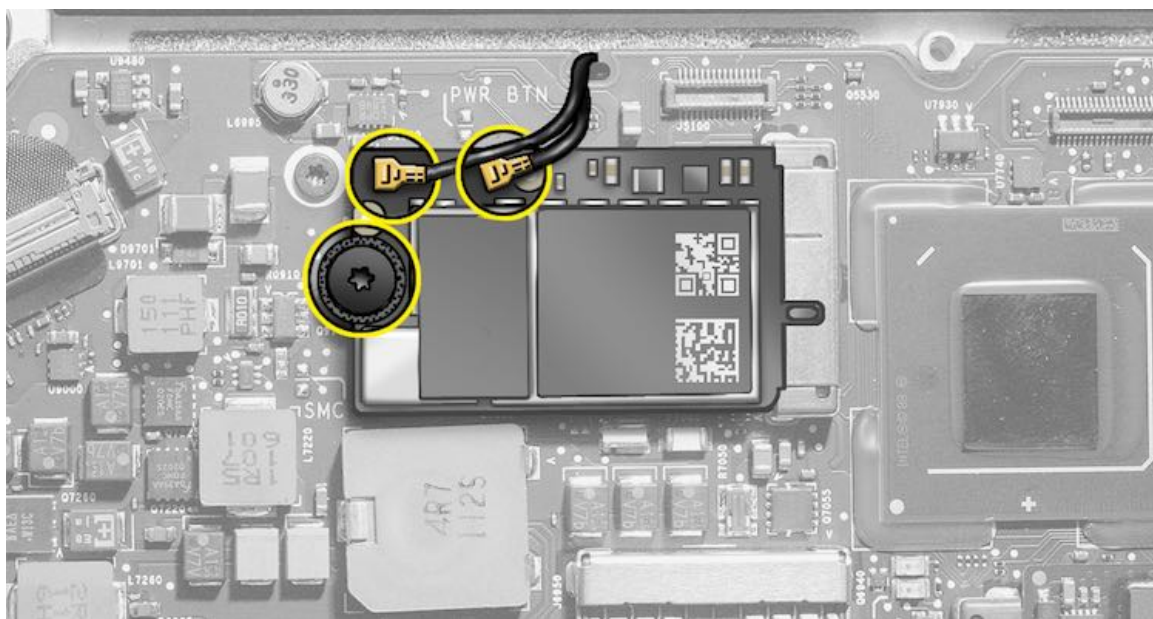
- Card does not use ring
- Back side of card is uncovered





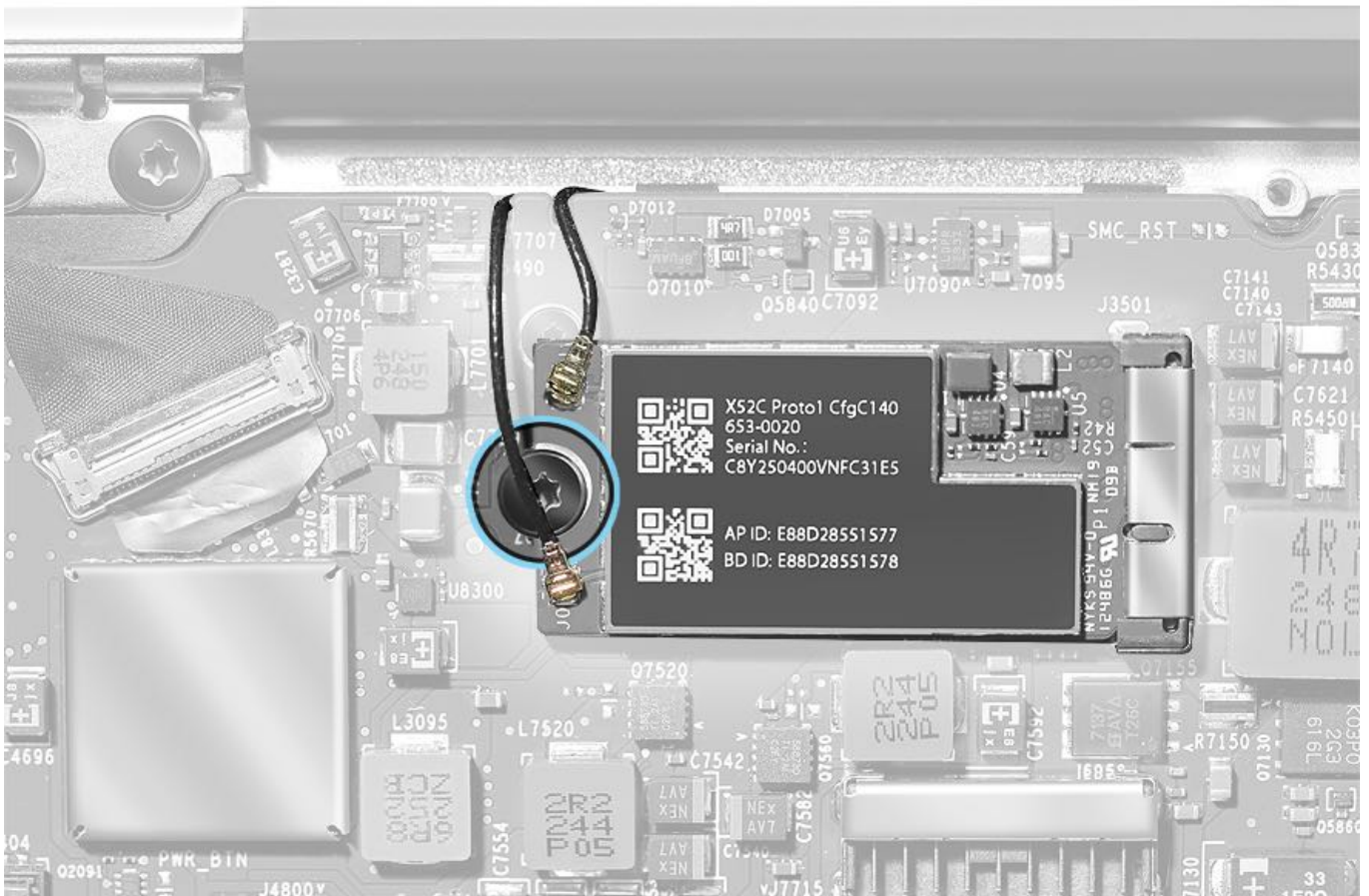
2. Holding card by the edges, connect card into logic board connector and install screw.

Important: Make sure cables are untwisted and routed properly through notch in logic board.

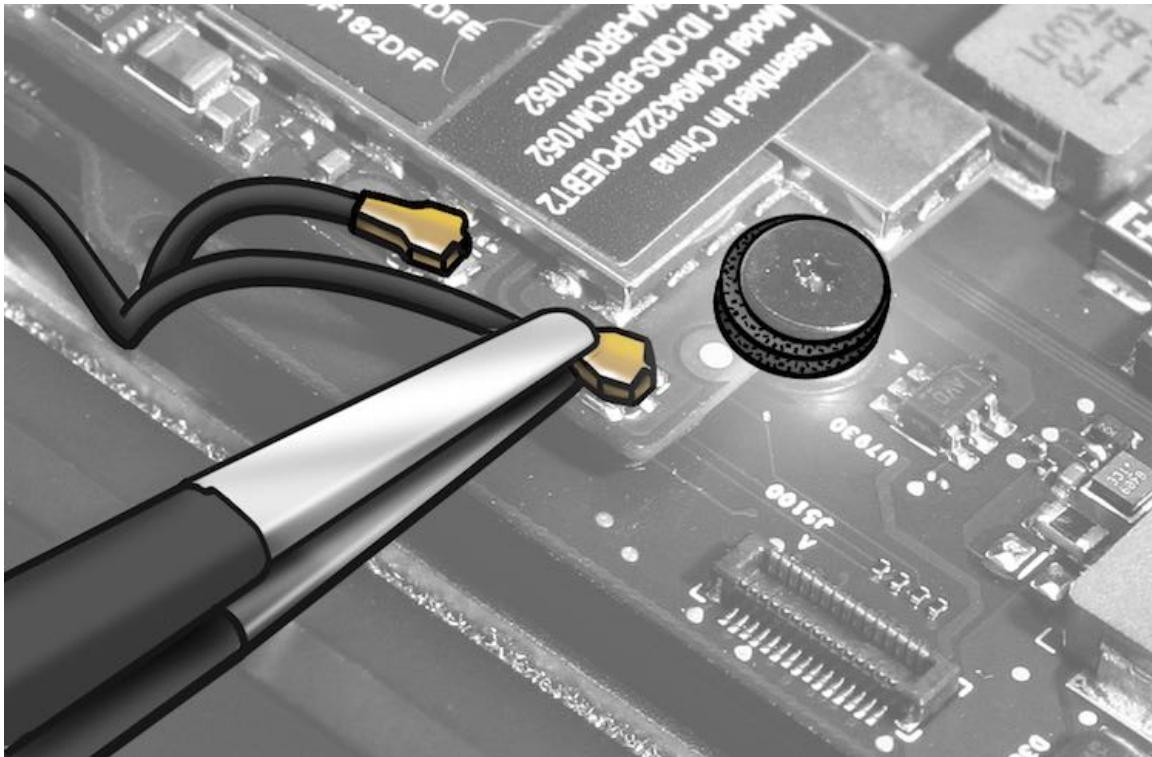


Mid 2013, Early 2014, and Early 2015

Note: The logic board has two notches for the wireless antenna cables on the **Mid 2013, Early 2014, and Early 2015** models:



3. **Caution:** Using too much force to reseat antenna cables can distort connector or connector rim. Using tweezers, position antenna head over connector until you feel it seat with connector. Then carefully press straight down with a finger until head snaps into place. Make sure slightly longer cable connects near corner of the card. Do not swap cables.



Input/Output (I/O) Flex Cable

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT202594: Exams for Service Technicians](#).

For video instruction, refer to article [SV186: I/O Flex Replacement Video](#).

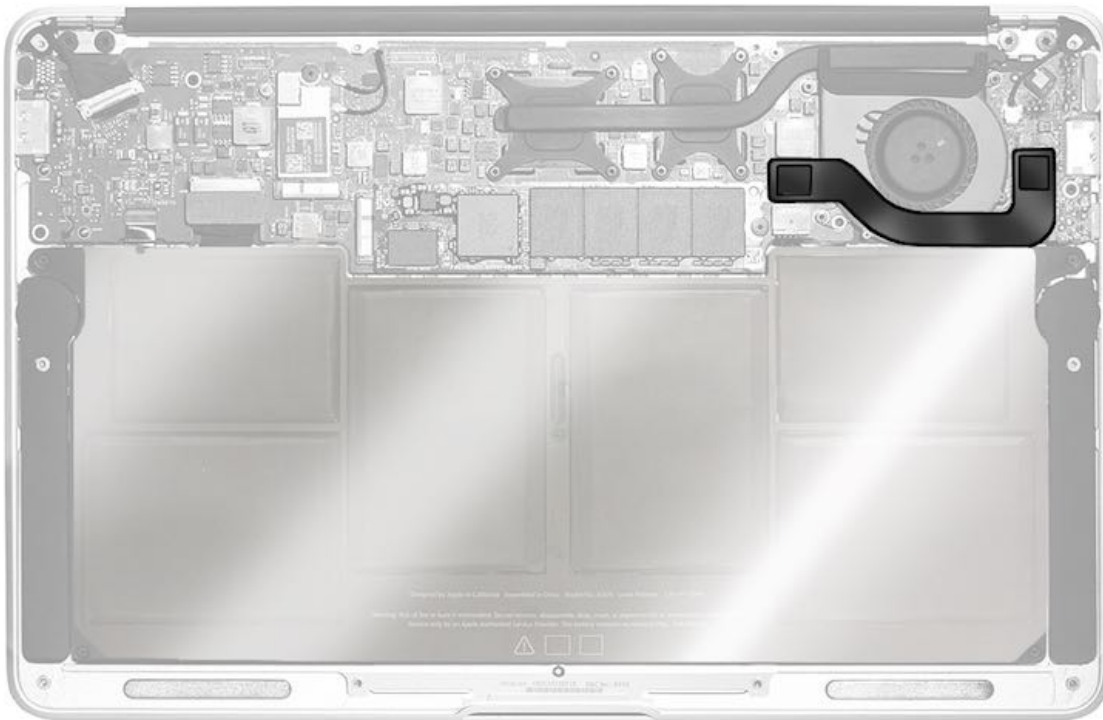
Remove:

- [Bottom Case](#)



Important: Immediately after removing the bottom case, always attach the battery cover and disconnect the battery cable from the logic board.

Caution: Read [Battery Safety Precautions](#) before beginning this procedure.



Tools

- ESD wrist strap
- Black stick

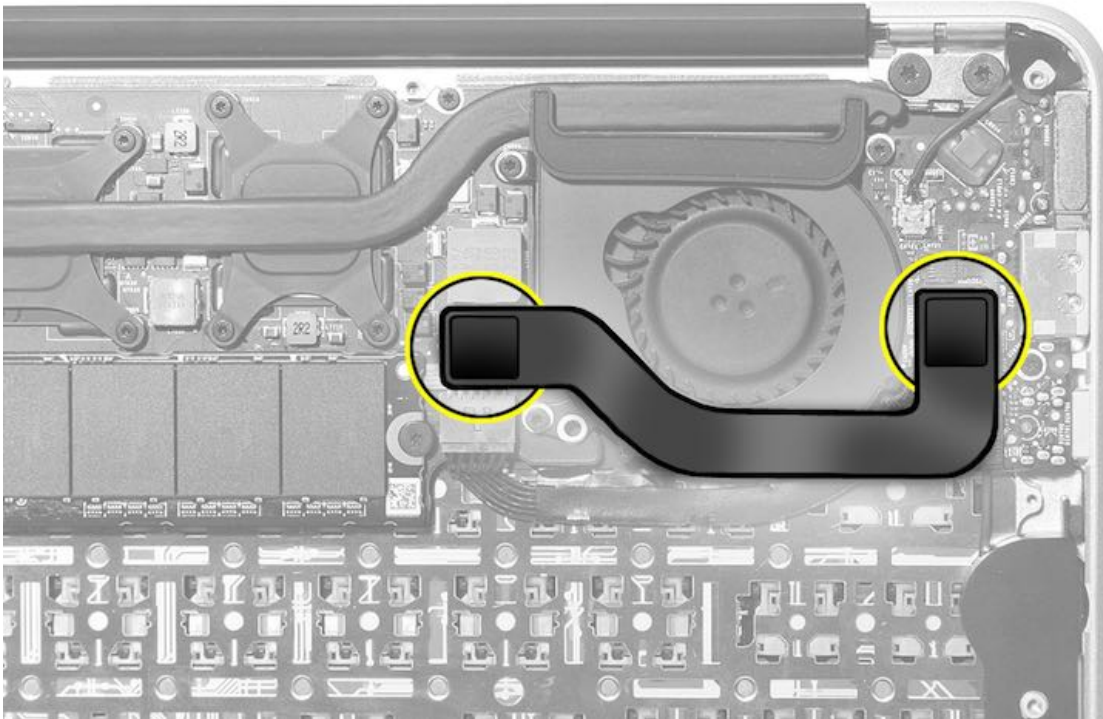


Steps For Removal

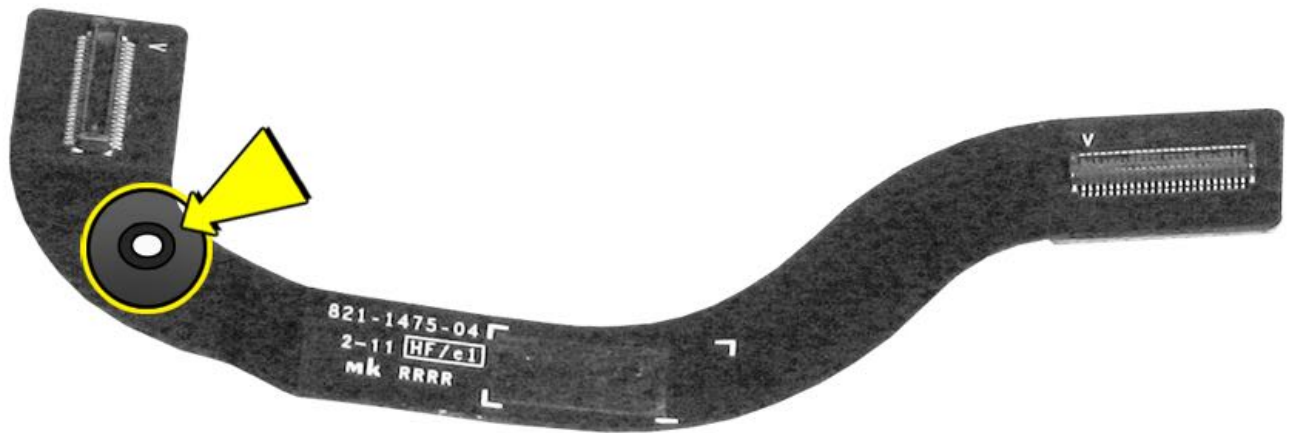
1. Use a black stick at each connector to disconnect cable straight up from logic board and I/O board.

2. Peel up cable from adhesive on fan.

Replacement Note: Before installing cable, check the connectors on each board for any pin deformities. For more information on reseating the I/O flex cable, see article [OP490: Alignment and reseating of LIO Flex Cable](#).



Note: I/O flex cable has a liquid contact indicator on underside of cable.



Mid 2013, Early 2014, and Early 2015:



Steps For Reassembly

Reassemble in reverse order of removal steps.

Fan

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT202594: Exams for Service Technicians](#).

For video instruction, refer to article [SV178: Fan Replacement Video](#).

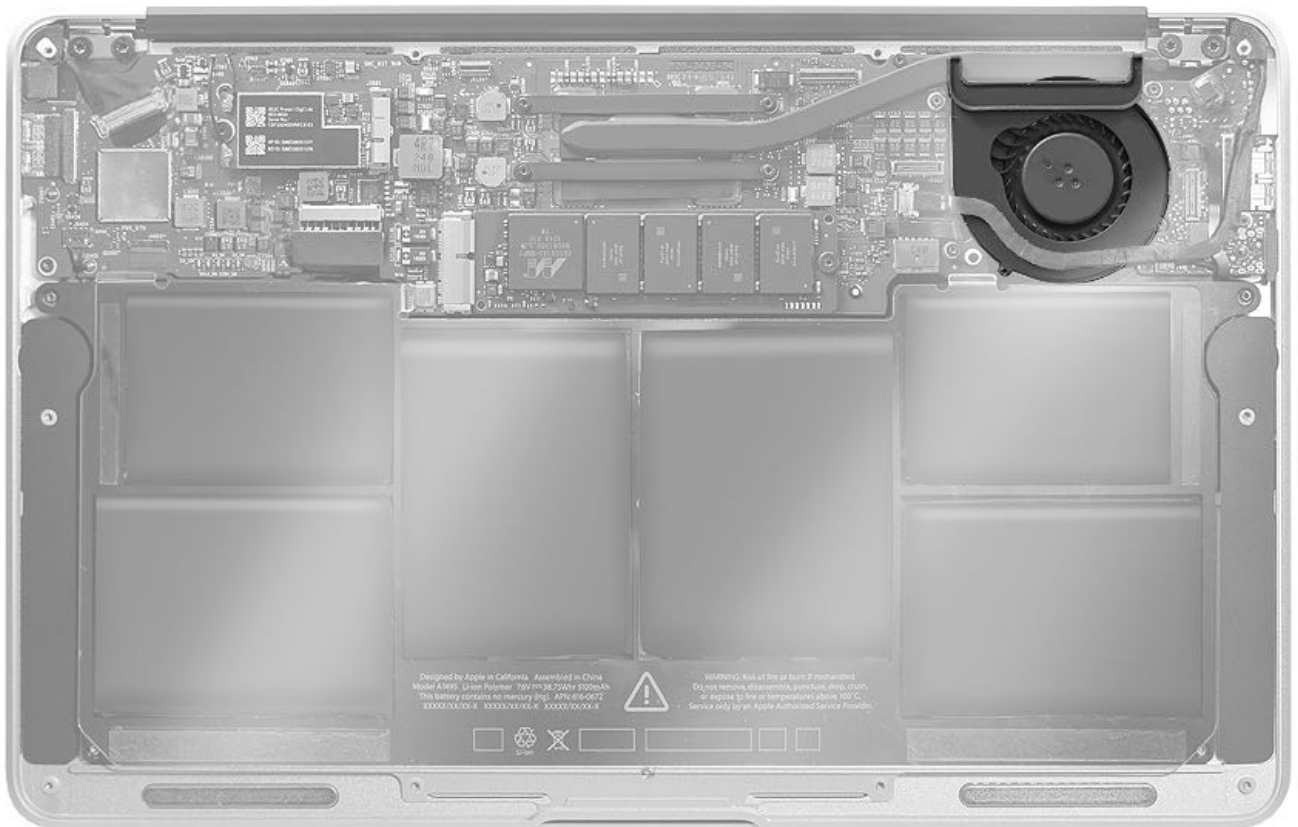
Remove:

- [Bottom Case](#)
- [I/O Flex Cable](#)



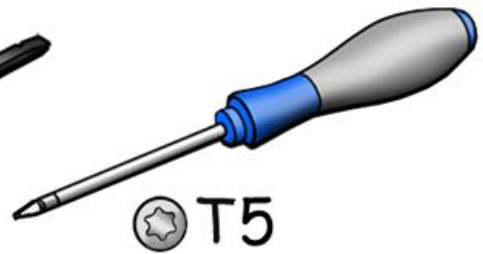
Important: Immediately after removing the bottom case, always attach the battery cover and disconnect the battery cable from the logic board.

Caution: Read [Battery Safety Precautions](#) before beginning this procedure.



Tools

- ESD wrist strap
- Black stick
- Torx T5 screwdriver, magnetized



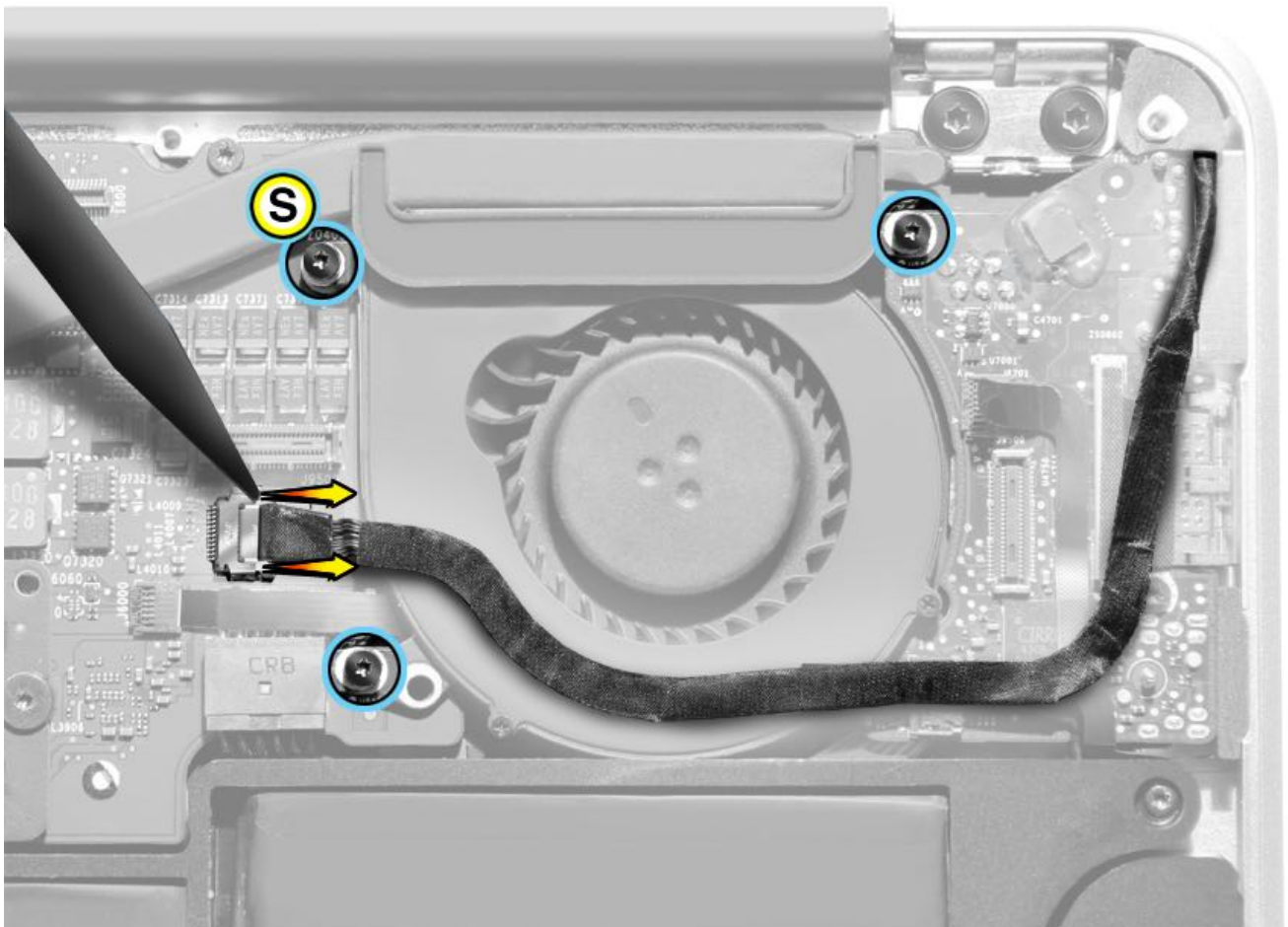
T5

Steps For Removal

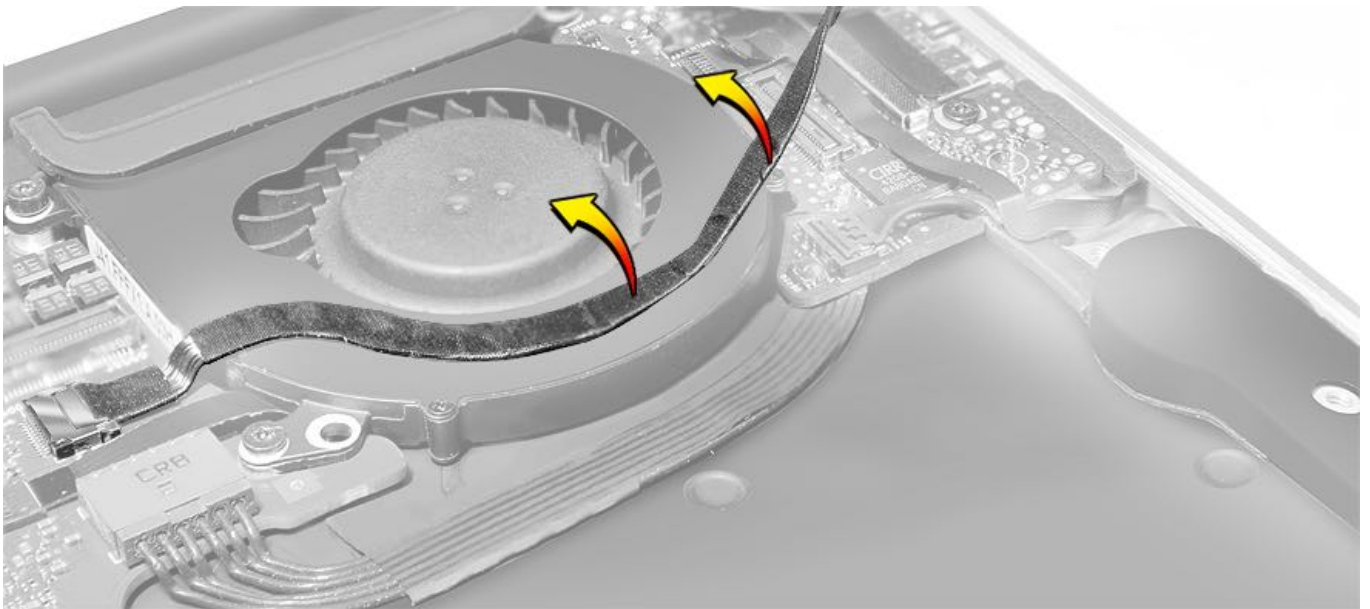
1. Disconnect camera cable.
2. Remove three Torx T5 screws (short = S):
 - One short (S) 922-9692 (3.62 mm)



- Two 922-9691 (5.2 mm)



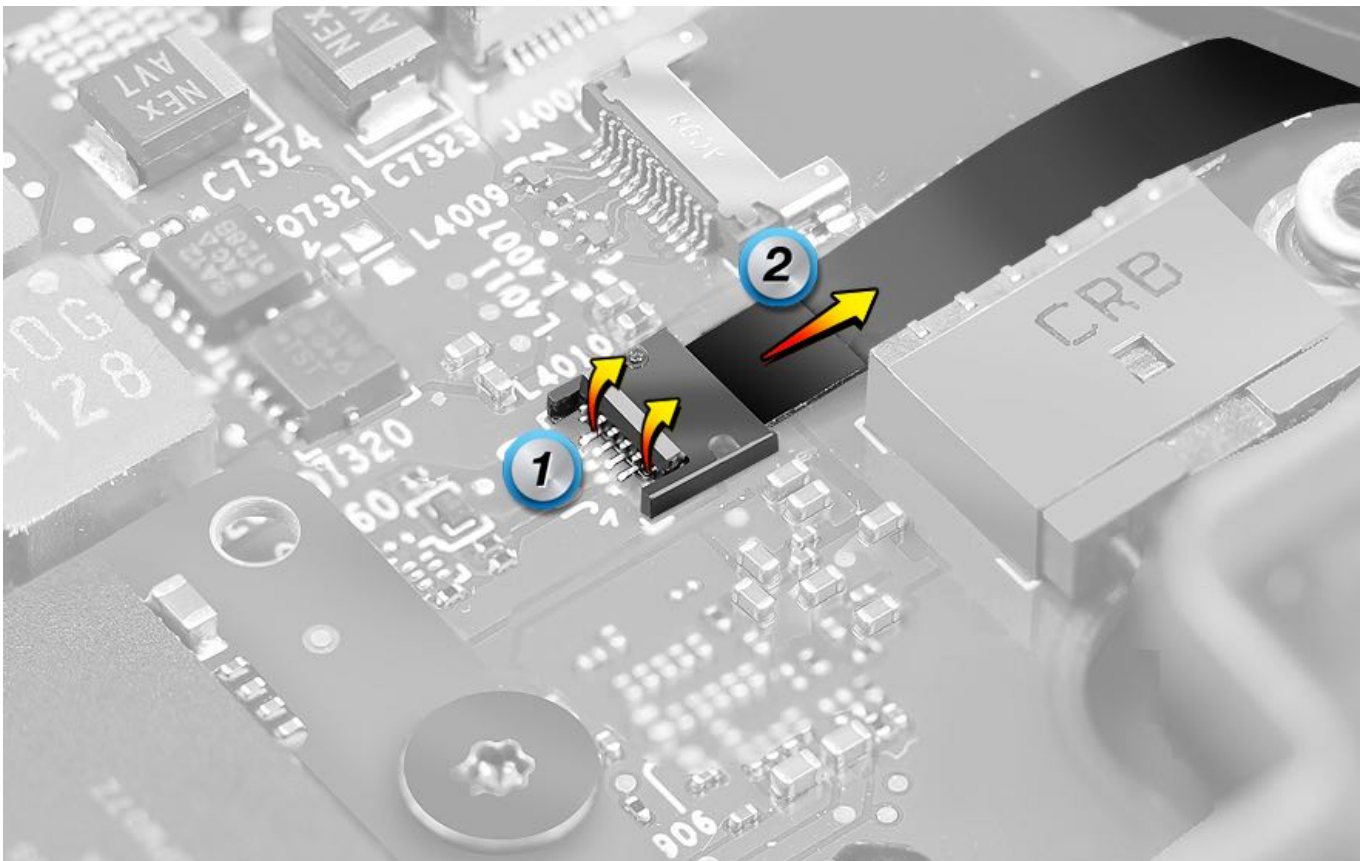
3. Peel up camera cable from adhesive on fan.



4. Flip up locking lever and carefully disconnect flexible fan cable.

Caution: Pulling the fan cable too fast could tear it.

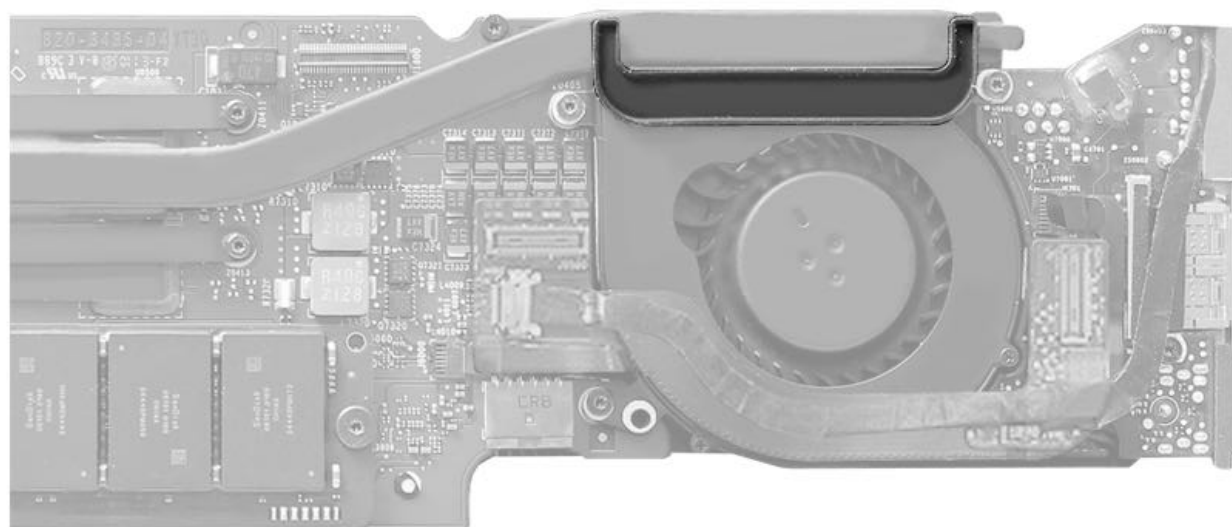
5. Tilt up fan from the left.



Steps For Reassembly

Replacement Notes:

- Connect fan cable before tilting fan into top case.
- Transfer rubber gasket if new fan does not include it.



Input/Output (I/O) Board

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT202594: Exams for Service Technicians](#).

For video instruction, refer to articles [SV197: I/O Board Replacement Video](#) (Mid 2012) and [SV179: I/O Board Replacement Video](#) (Mid 2013, Early 2014, and Early 2015).

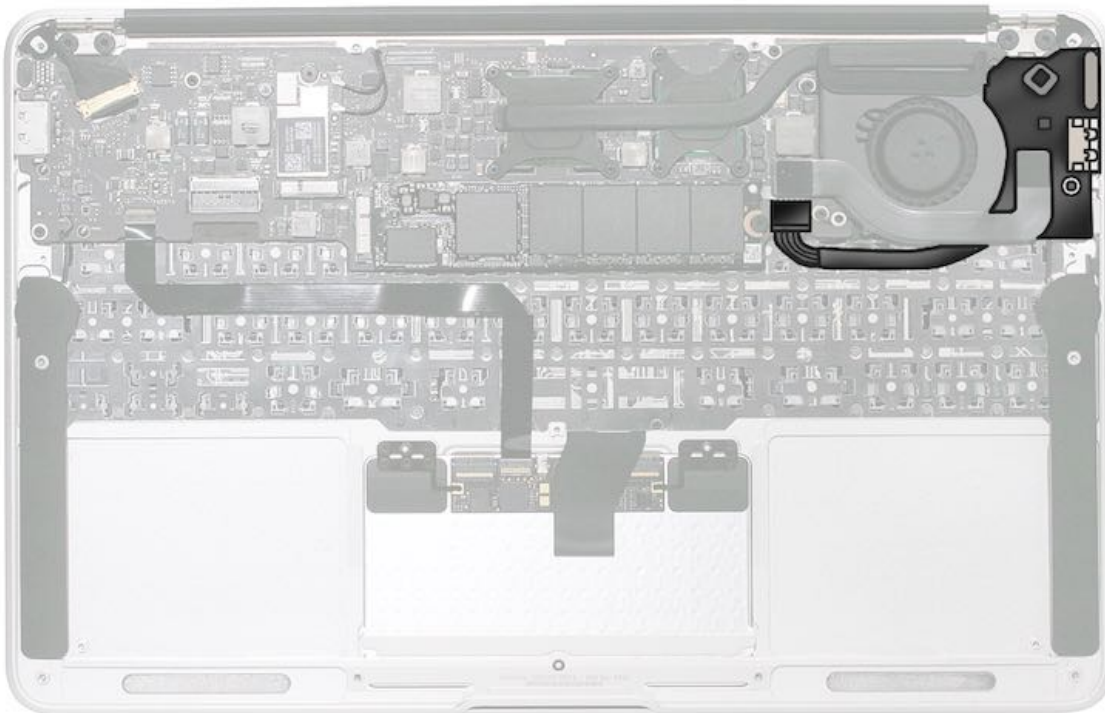
Remove:

- [Bottom Case](#)
- [Battery](#)
- [I/O Flex Cable](#)
- [SSD Card or Flash Storage](#)
- [Fan](#) (Late 2010, Mid 2011, and Mid 2012)
- [Fan](#) (Mid 2013, Early 2014, and Early 2015)



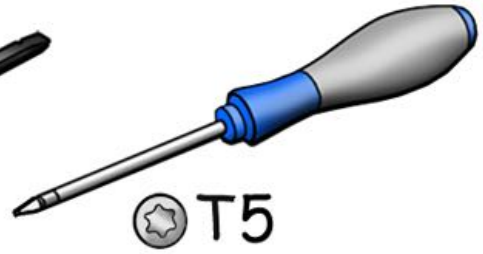
Important: Immediately after removing the bottom case, always attach the battery cover and disconnect the battery cable from the logic board.

Caution: Read [Battery Safety Precautions](#) before beginning this procedure.



Tools

- ESD wrist strap
- Black stick
- Torx T5 screwdriver, magnetized



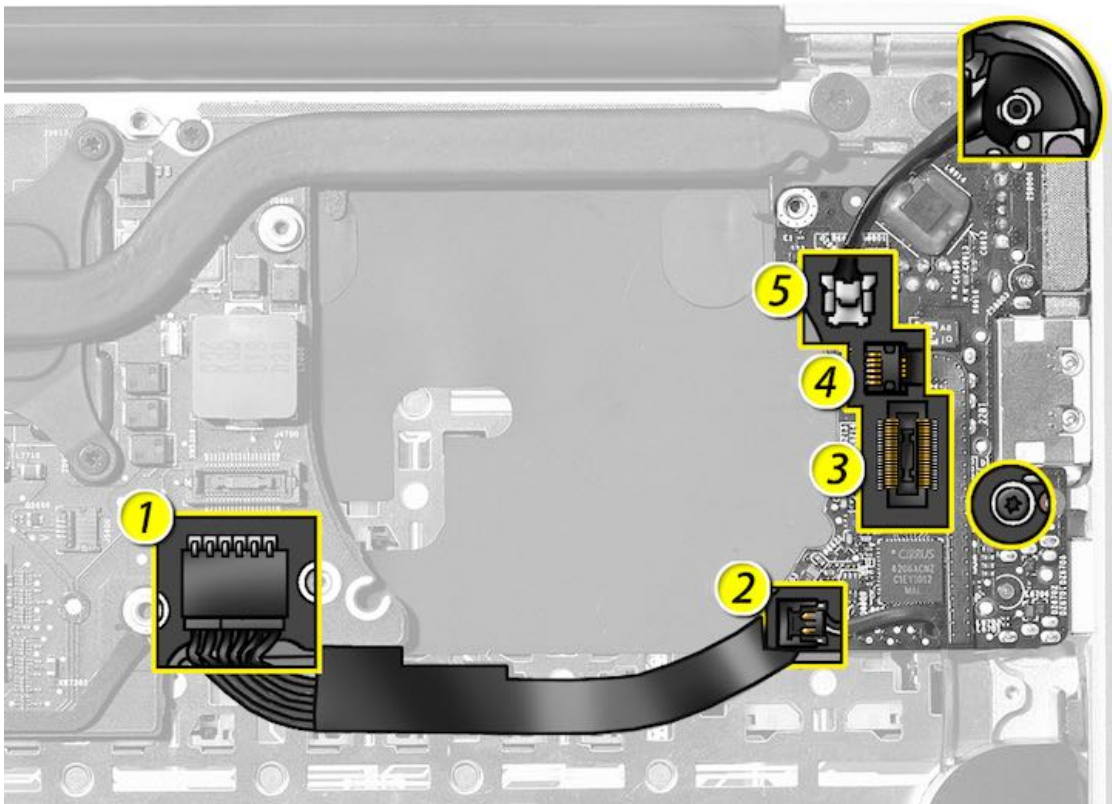
Steps For Removal

1. Use black stick to pry up wedge-shaped rubber gasket in corner.
2. Remove Torx T5 screw, 922-9692 (3.62 mm)



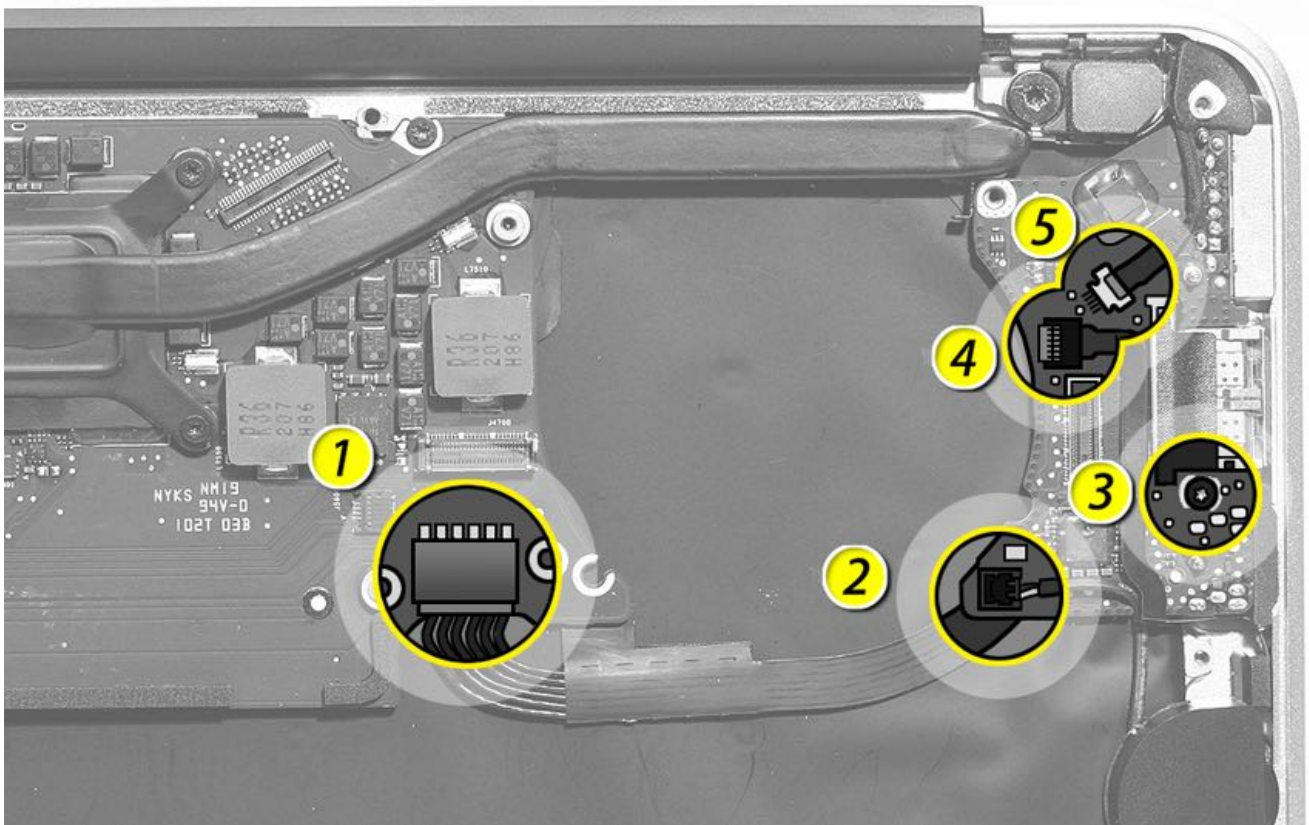
3. **Late 2010 and Mid 2011:** Referring to numbers on image, disconnect:

1. Power cable to logic board
2. Left speaker cable
3. I/O flex cable (removed previously)
4. Microphone cable
5. Camera cable (refer to step 6)



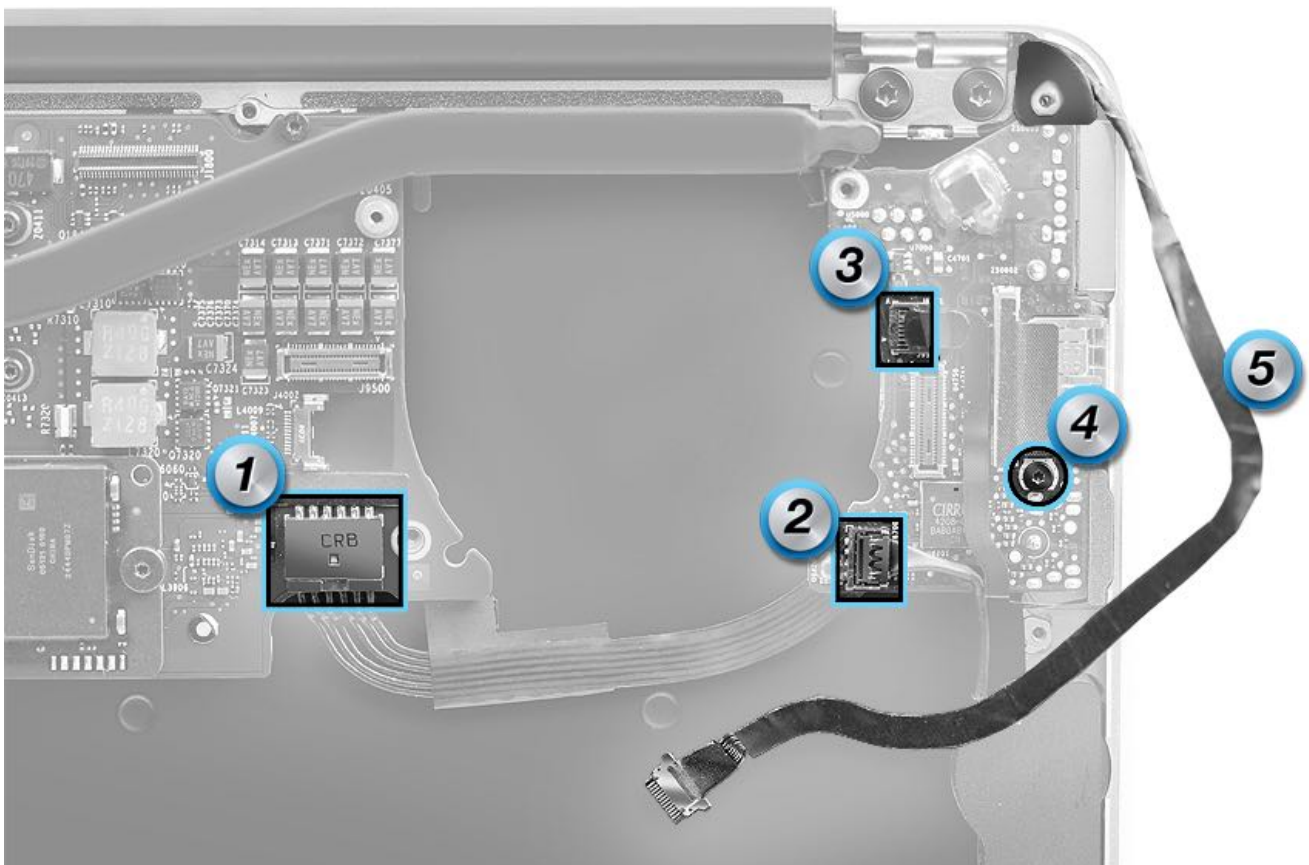
Mid 2012: Referring to numbers on image, disconnect:

1. Power cable to logic board
2. Left speaker cable
3. I/O board screw
4. Microphone cable
5. Camera cable (refer to step 7)

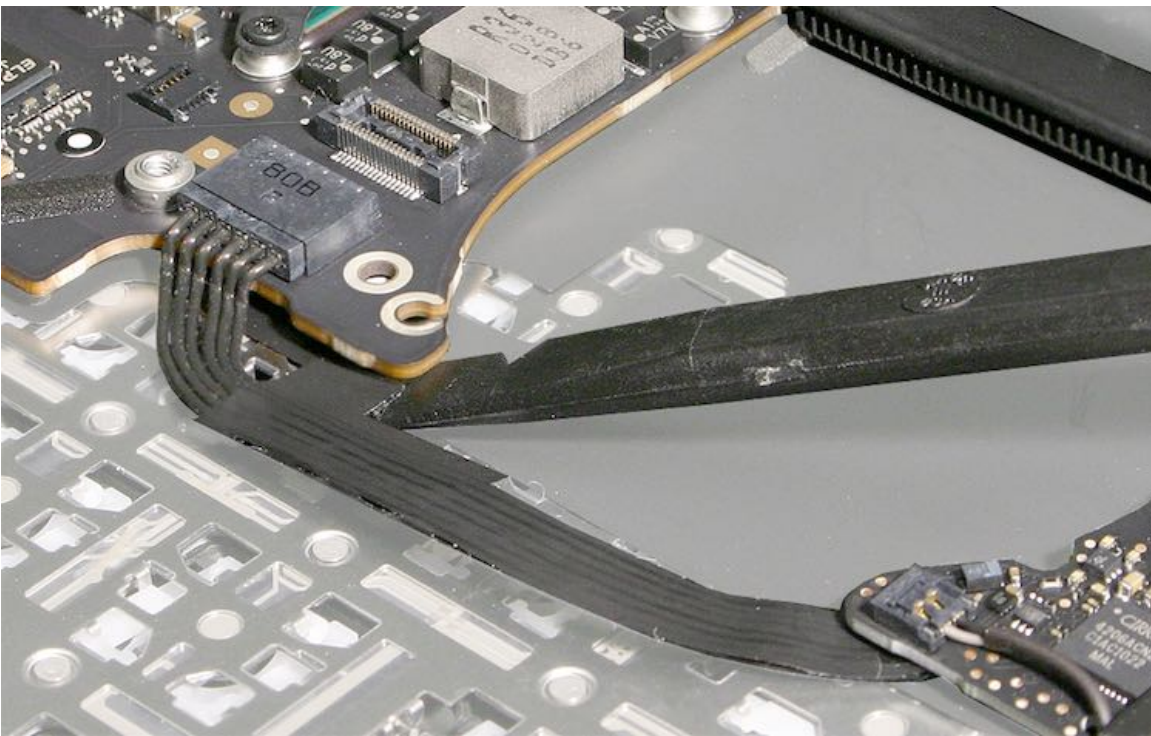


Mid 2013, Early 2014, and Early 2015: Referring to numbers on image, disconnect:

1. Power cable to logic board
2. Left speaker cable
3. Microphone cable
4. I/O board screw
5. Camera cable (disconnected previously when fan was removed)

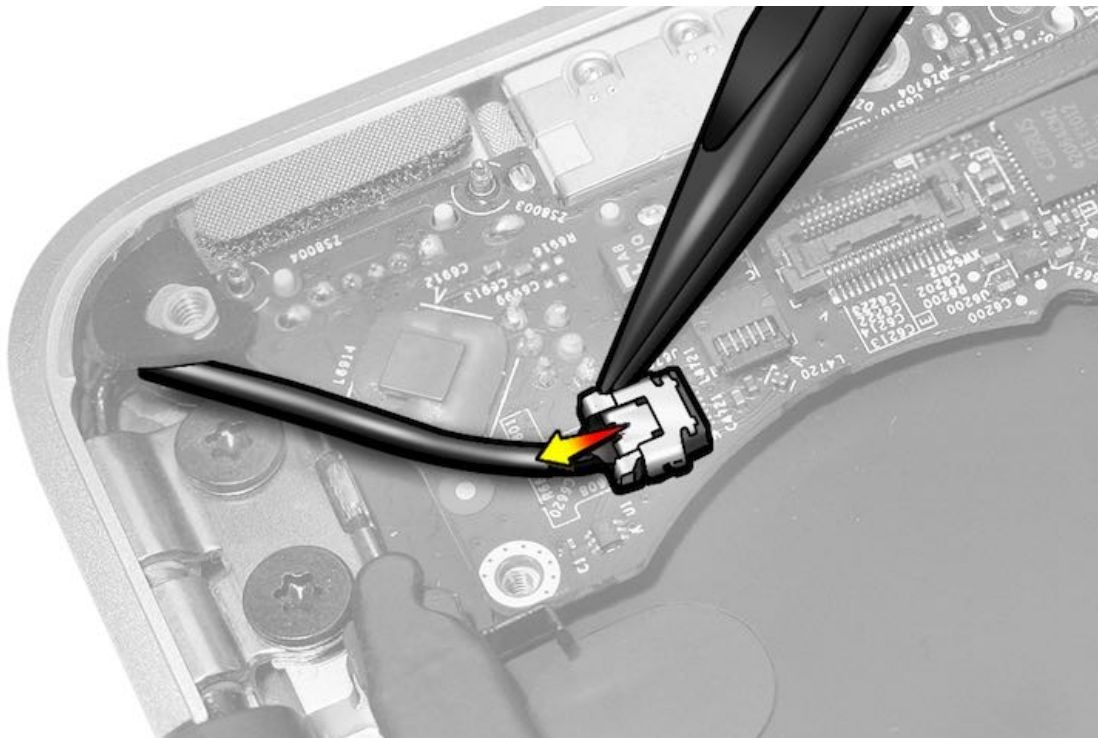


4. Use a black stick to loosen cable tape under lower corner of logic board.

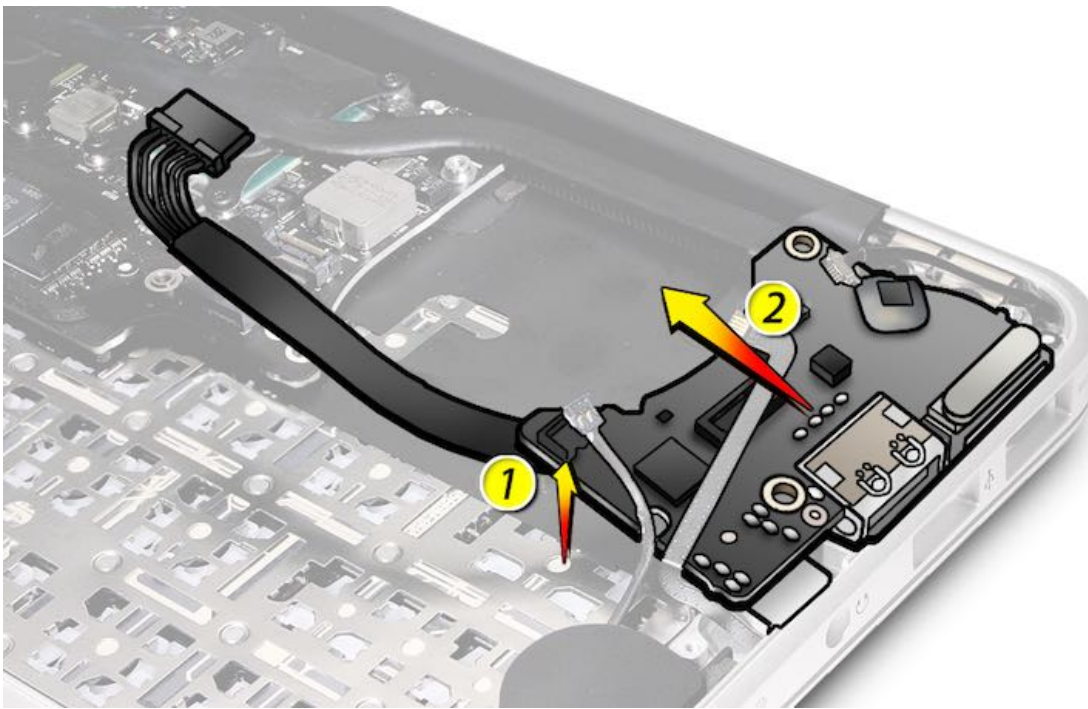


5. When disconnecting camera cable, use a black stick on alternate sides to disconnect cable evenly.

Note: Skip this step for Mid 2013, Early 2014, and Early 2015 models. Camera cable is in a slightly different position for Mid 2012 model, refer to image in step 3.



6. Tilt up board and move it away from ports and out of top case.

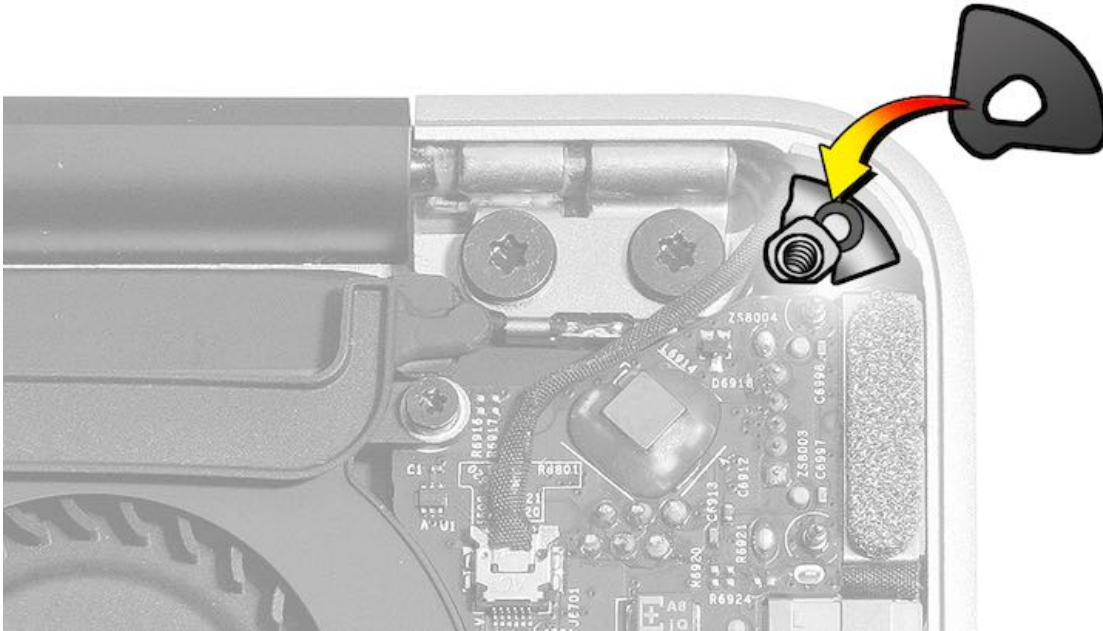


Steps For Reassembly

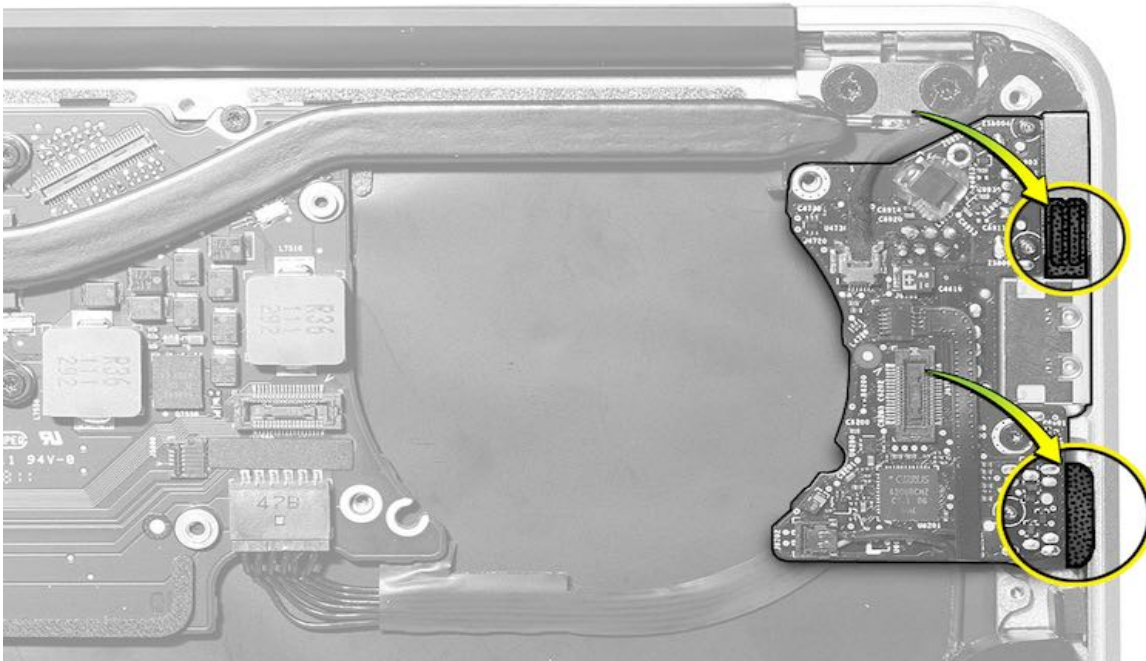
1. Without pinching cables, tip board into top case and push it against top case wall to secure ports.
2. Check screw and port alignment before installing screws.
3. Connect remaining cables.

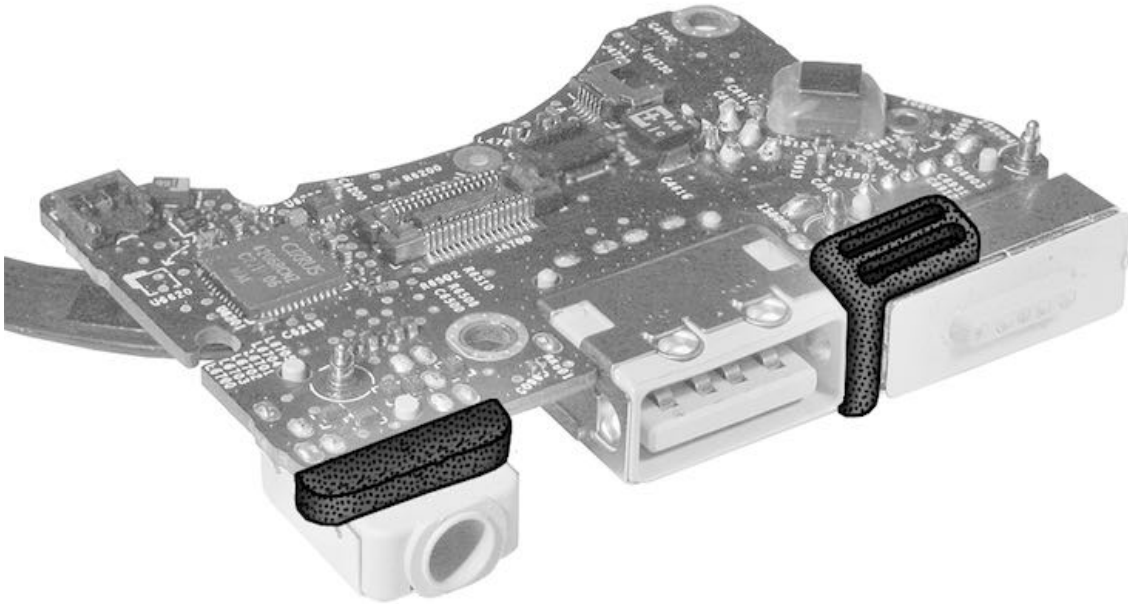


4. Insert rubber gasket as shown. (The gasket shape is unique for each rear corner).

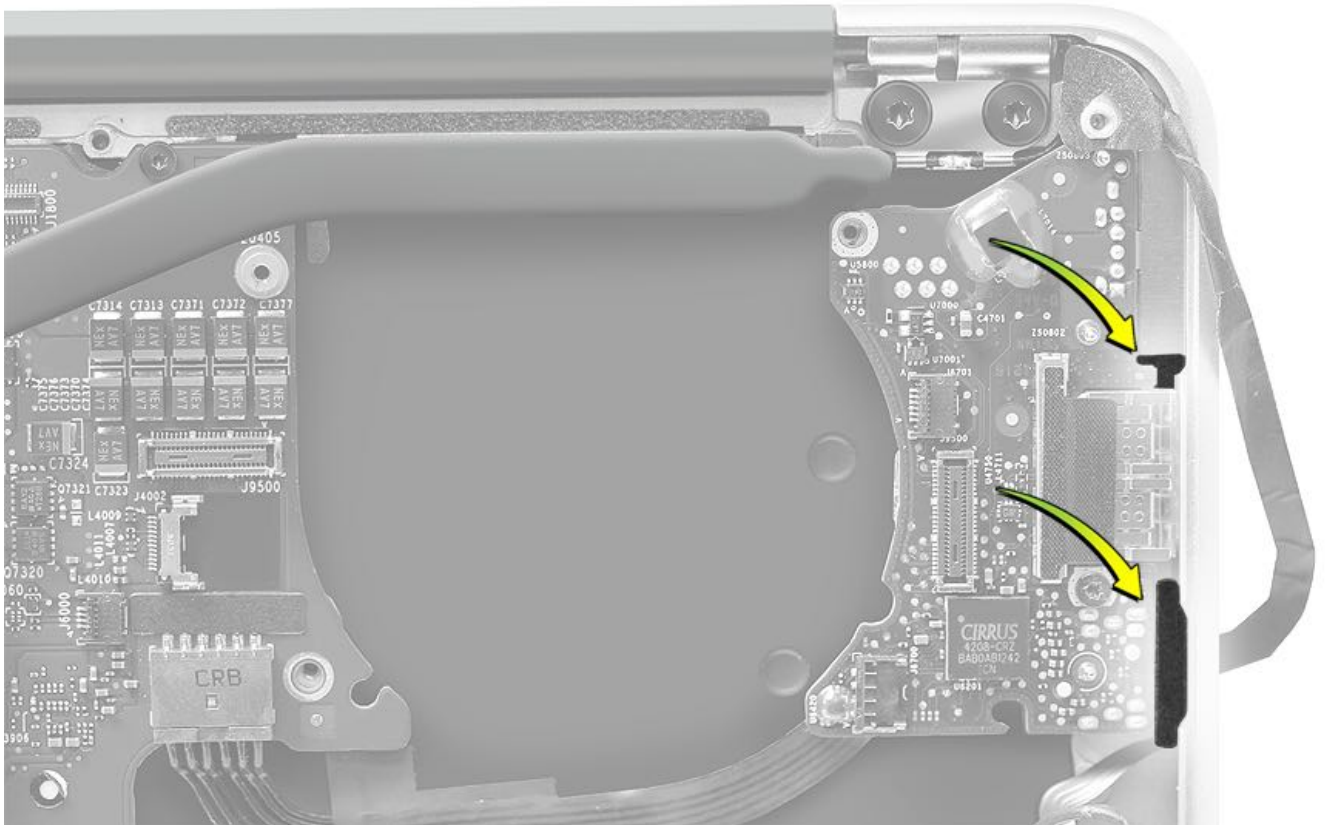


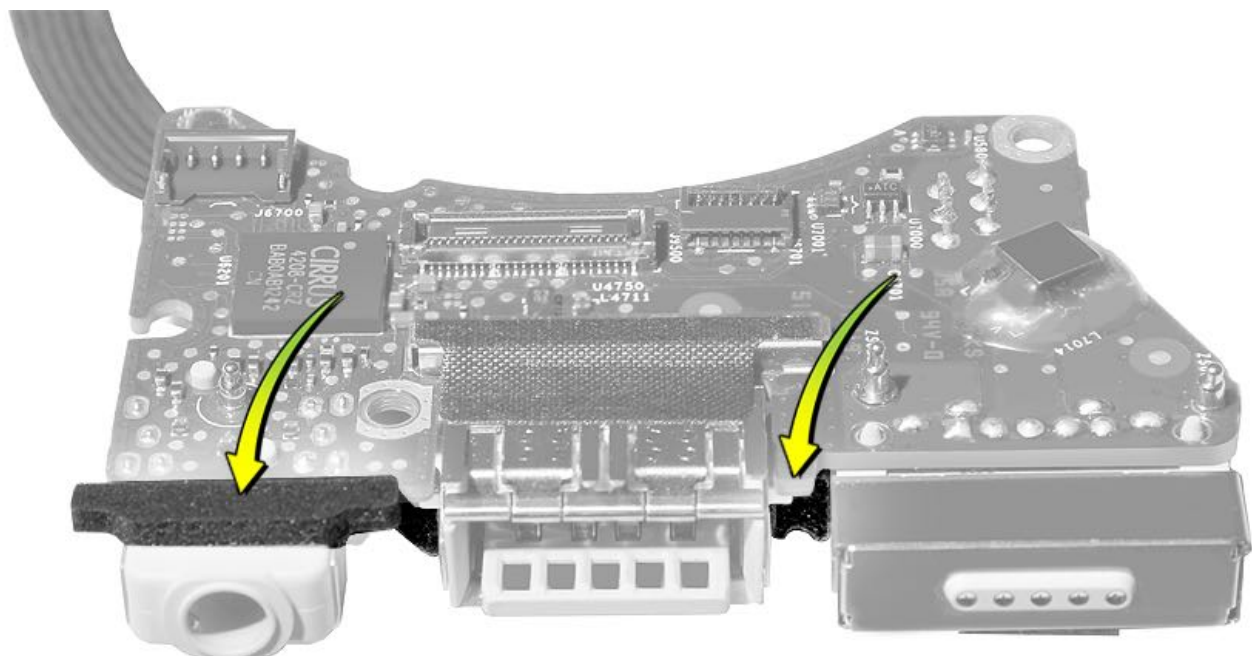
Replacement note for Mid 2011 and Mid 2012 models only: Make sure rubber gasket and foam strip are installed on I/O board.





Replacement note for Mid 2013, Early 2014, and Early 2015 models only: Make sure rubber gasket and foam strip are installed on I/O board.





Input Device (IPD) Flex Cable

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT202594: Exams for Service Technicians](#).

For video instruction, refer to article [SV188: IPD Flex Replacement Video](#).

Remove:

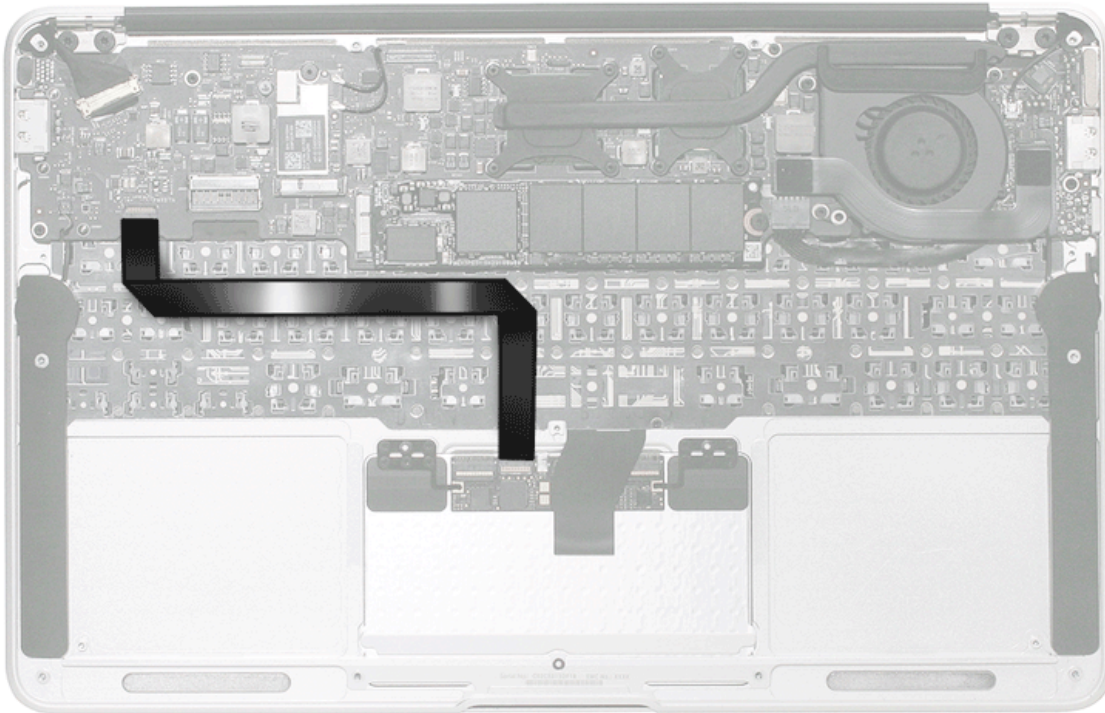
- [Bottom Case](#)
- [Battery](#)



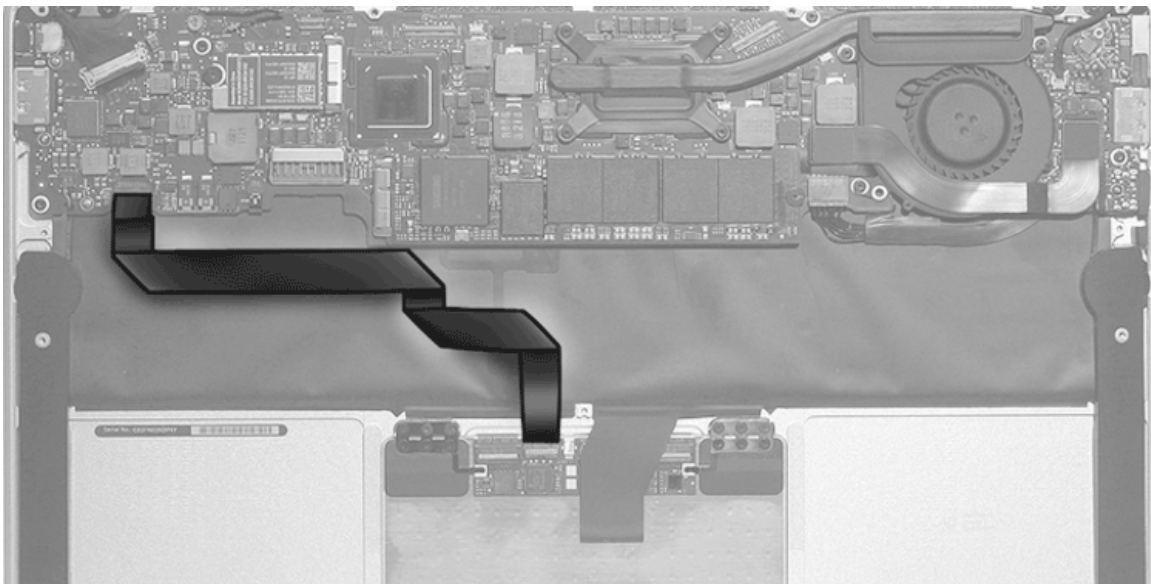
Important: Immediately after removing the bottom case, always attach the battery cover and disconnect the battery cable from the logic board.

Caution: Read [Battery Safety Precautions](#) before beginning this procedure.

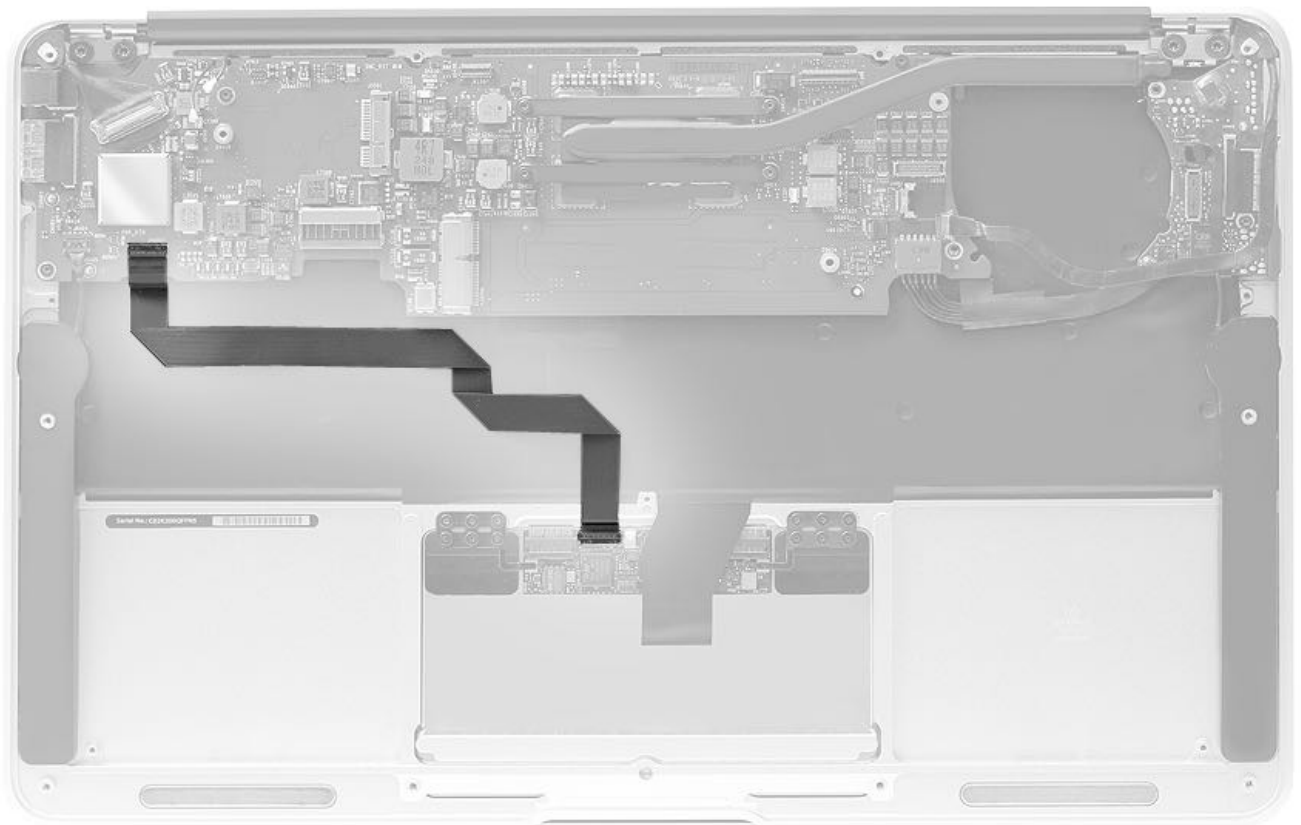
Late 2010



Mid 2011 and Mid 2012



Mid 2013, Early 2014, and Early 2015



Tools

- ESD wrist strap
- Black stick

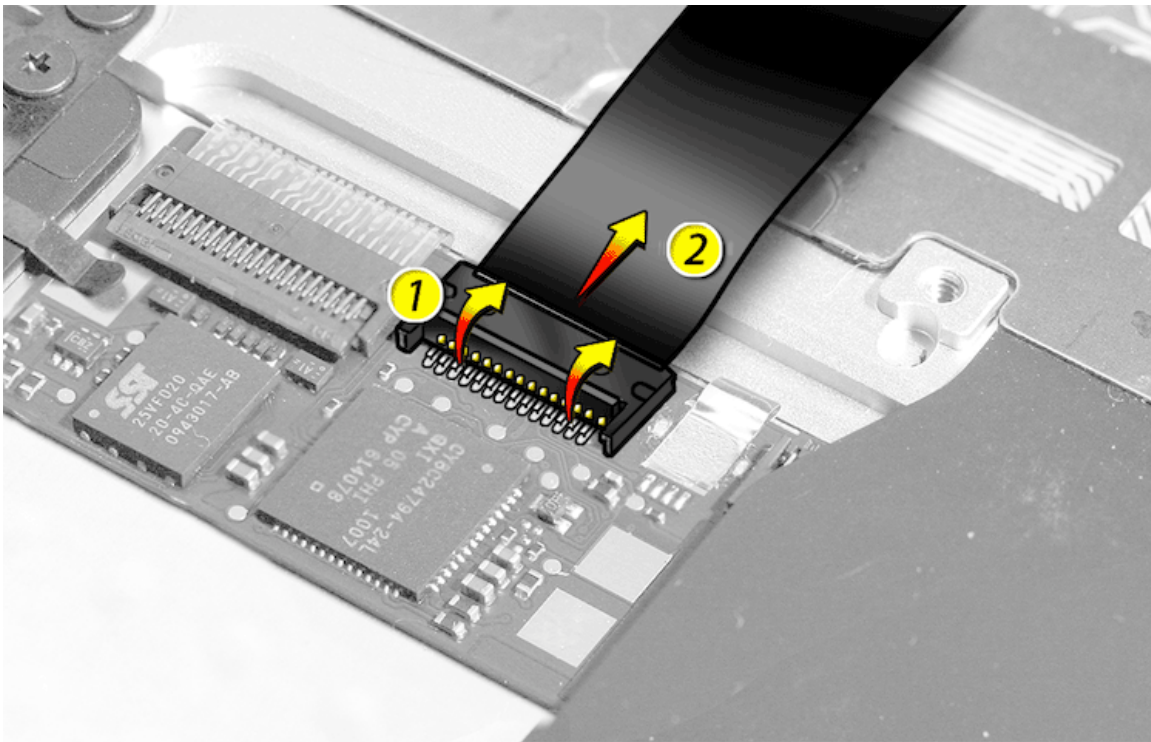


Steps For Removal

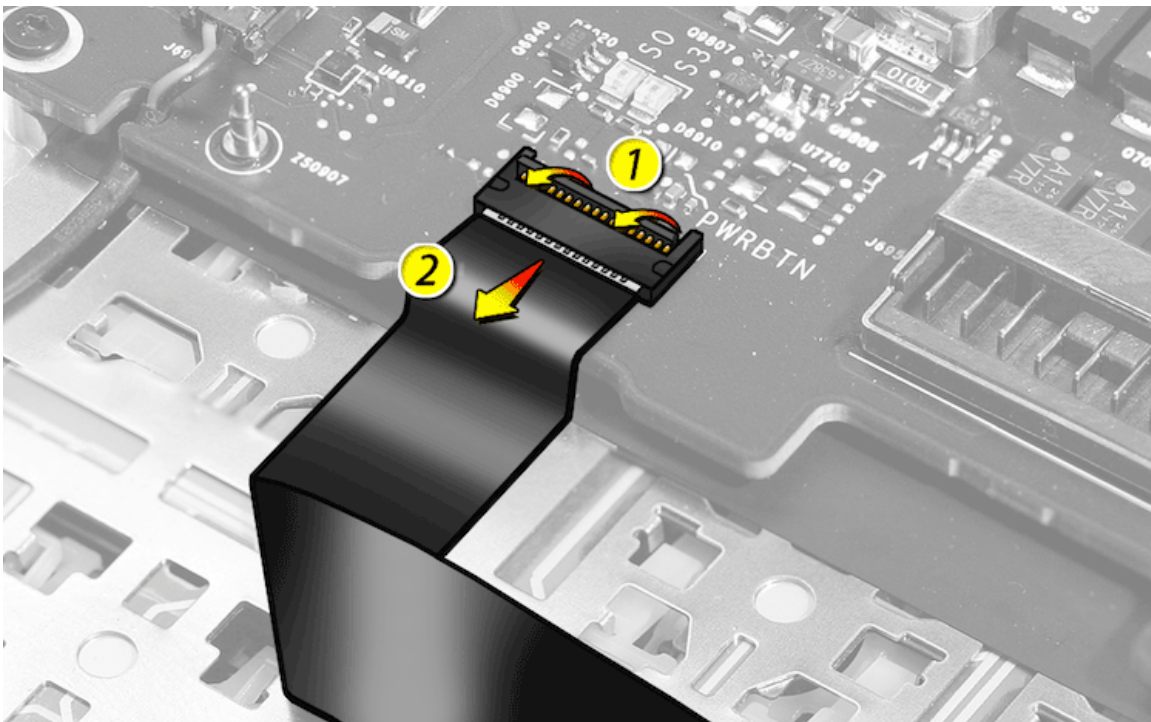
1. Disconnect cable from flip-lever connector at trackpad.

2. Peel up cable from top case.

Replacement Note: When installing new cable, peel off adhesive backing.



3. Disconnect cable from flip-lever connector at logic board.



Steps For Reassembly

Reassemble in reverse order of removal steps.

Heat Sink

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT202594: Exams for Service Technicians](#).

For video instruction, refer to articles [SV198: Heat Sink Replacement Video](#) (Mid 2012) or [SV180: Heat Sink Replacement Video](#) (Mid 2013, Early 2014, and Early 2015).

Remove:

- [Bottom Case](#)
- [I/O Flex Cable](#)
- [SSD Card](#) (Mid 2011 and Mid 2012)
- [Fan](#) (Late 2010, Mid 2011, and Mid 2012)
- [Fan](#) (Mid 2013, Early 2014, and Early 2015)



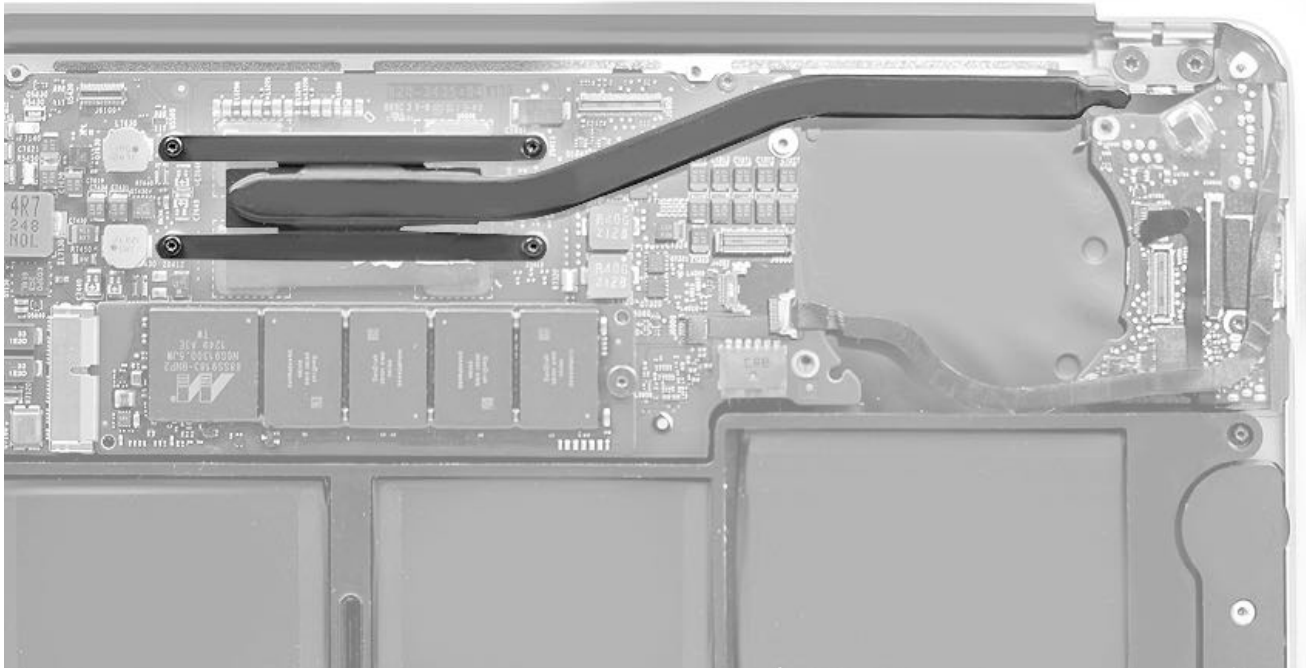
Important: Immediately after removing the bottom case, always attach the battery cover and disconnect the battery cable from the logic board.

Caution: Read [Battery Safety Precautions](#) before beginning this procedure.

Mid 2011 and Mid 2012



Mid 2013, Early 2014, and Early 2015



Tools

- ESD wrist strap
- Torx T5 screwdriver, magnetized
- Alcohol pads
- Thermal grease syringe, 922-7144
- Black stick



Steps For Removal

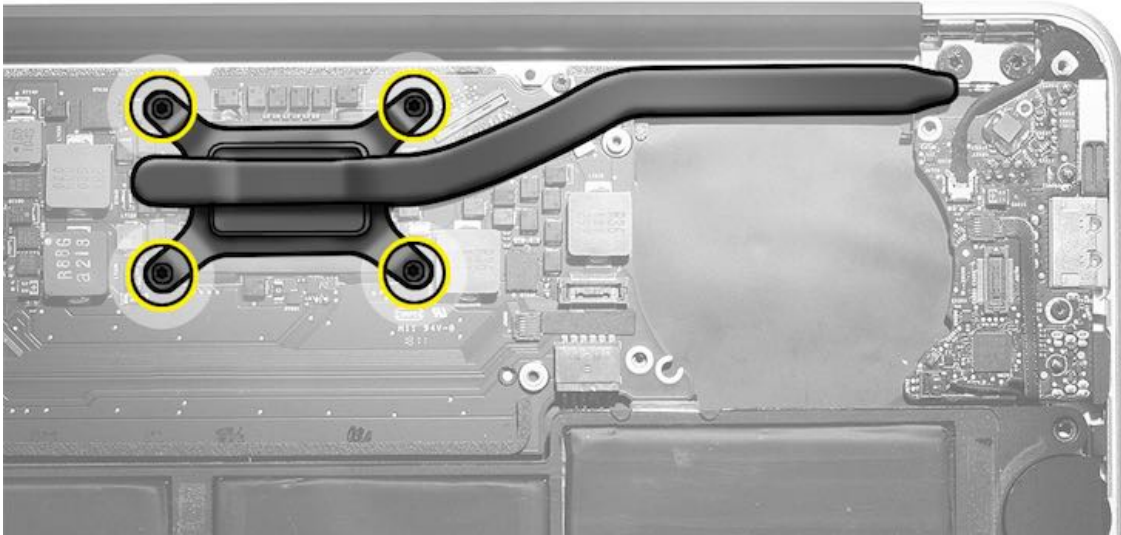


Caution: Do not grasp heat sink arm.

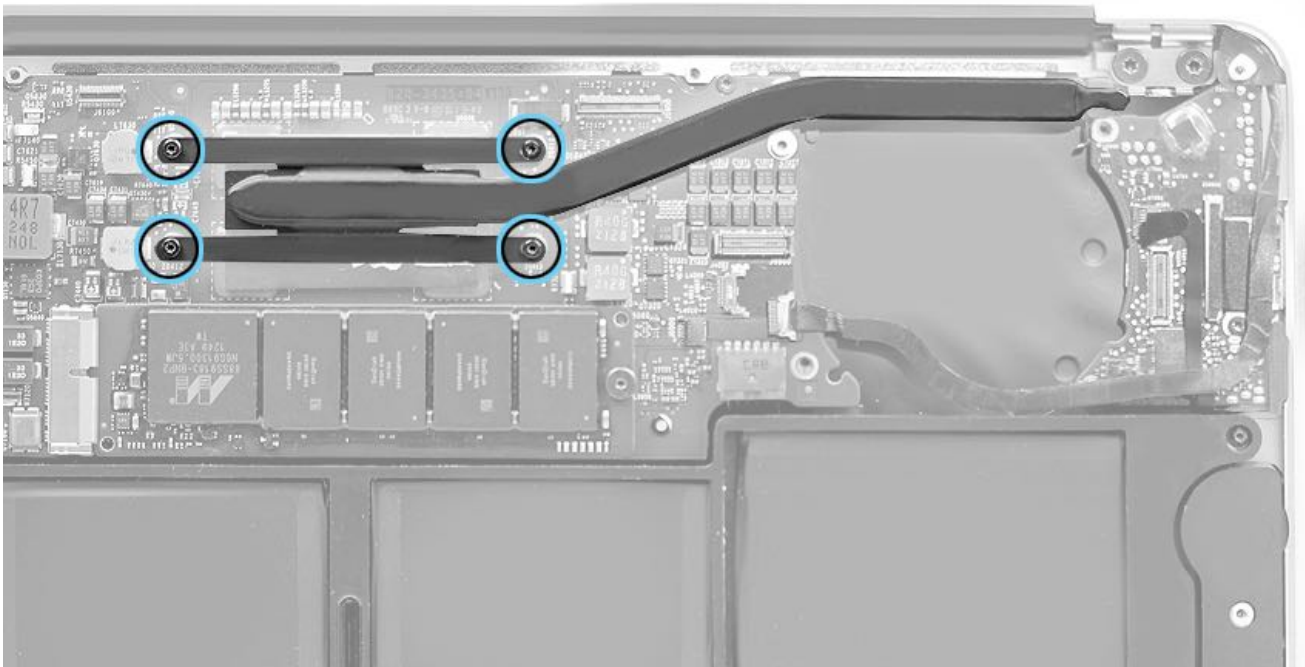
1. Remove four Torx T5 screws: 922-9694 (2.53 mm)



Mid 2011 and Mid 2012



Mid 2013, Early 2014, and Early 2015

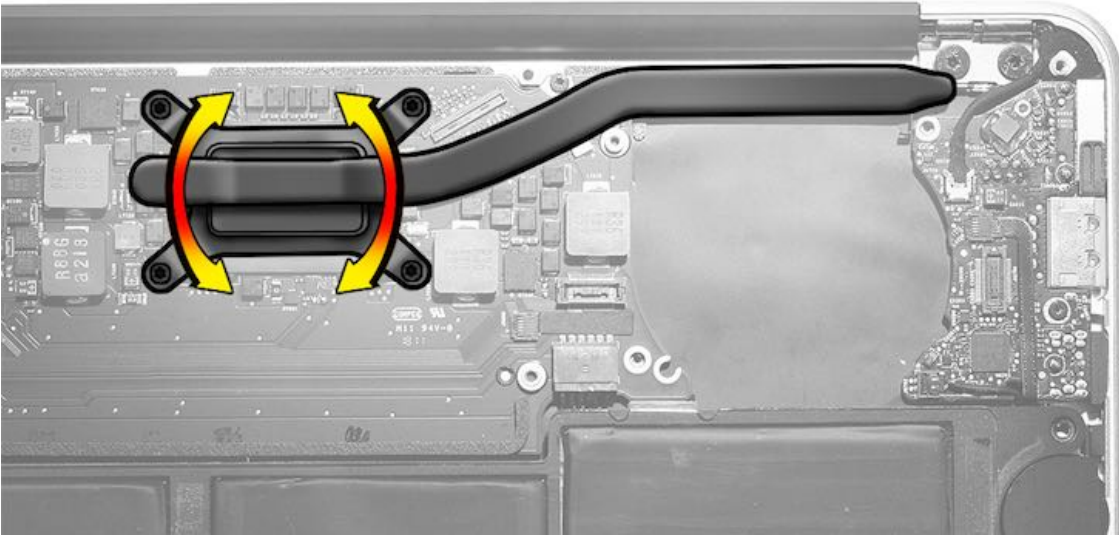


2. **Important:** To avoid flexing logic board, remove heat sink while logic board is secure in top case.

Keeping heat sink parallel to logic board, gently wiggle heat sink to loosen bond to logic board.

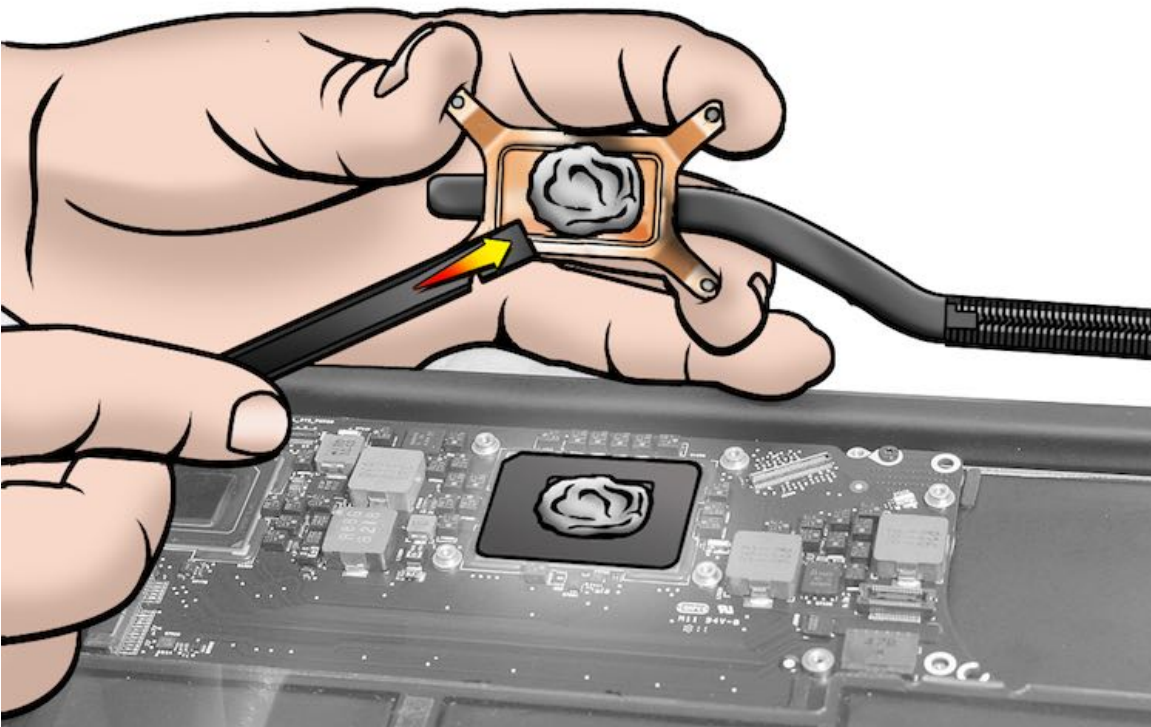


Caution: Do not pull heat sink.

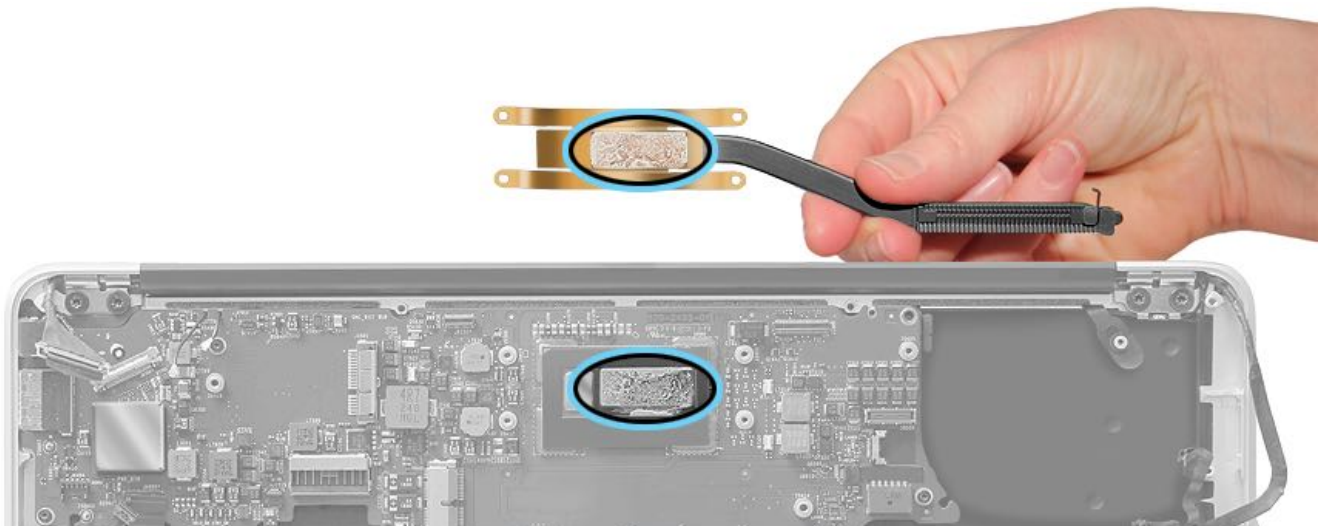


3. Scrape off thermal grease and use alcohol pad to clean thermal pad and chip.

Mid 2011 and Mid 2012:



Mid 2013, Early 2014, and Early 2015:

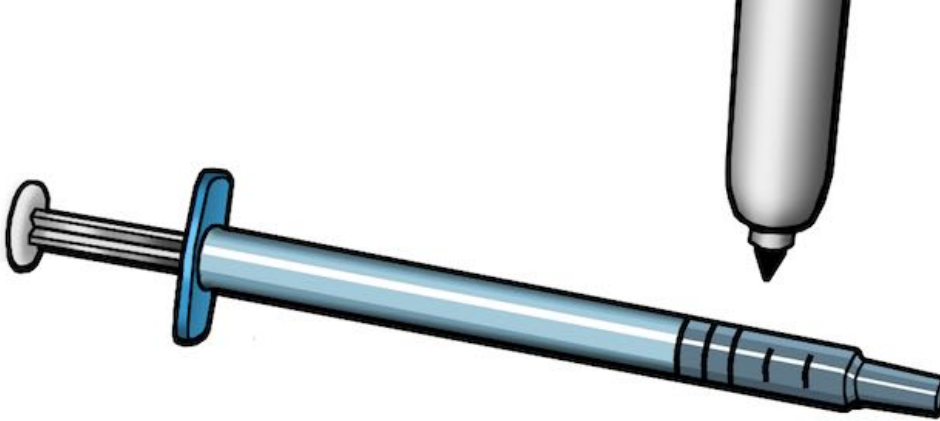


Steps For Reassembly

1. Use a pen to mark the syringe in thirds.

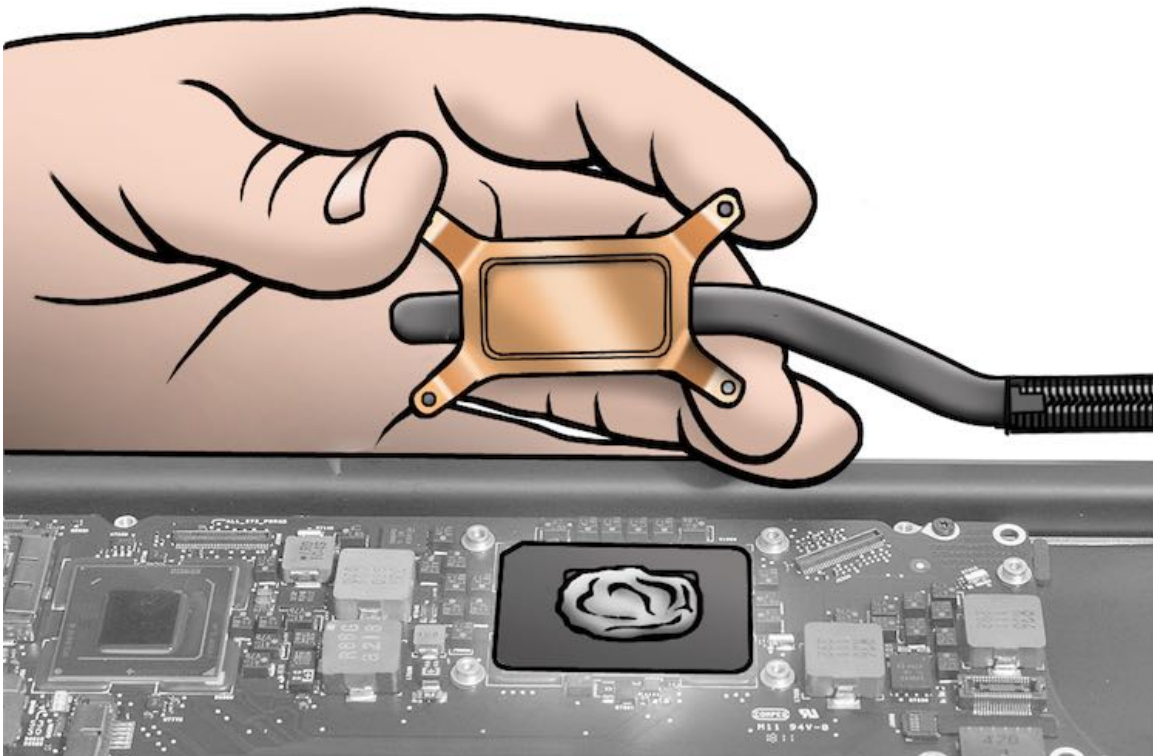


Caution: Syringe (922-7144) contains enough thermal grease for three chips. Because this computer has only one chip, use only one-third of syringe contents.



2. Inject one-third of grease on chip.
3. If logic board does not have Mylar frame, install it over chip.

Mid 2011 and Mid 2012



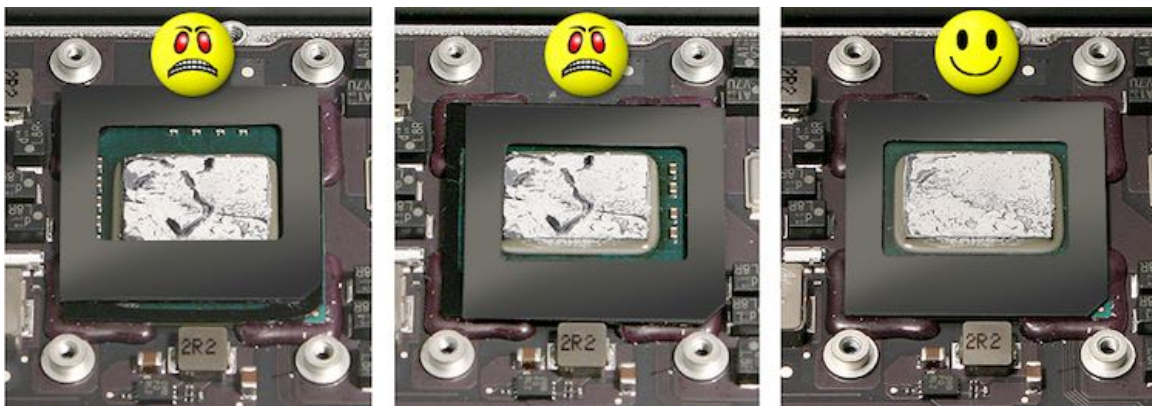
Mid 2013, Early 2014, and Early 2015

Important: For the Mid 2013, Early 2014, and Early 2015 models, place thermal grease in a two-dot pattern on the long chip. Make sure thermal grease is applied only to the long chip, not the clean chip to the left.

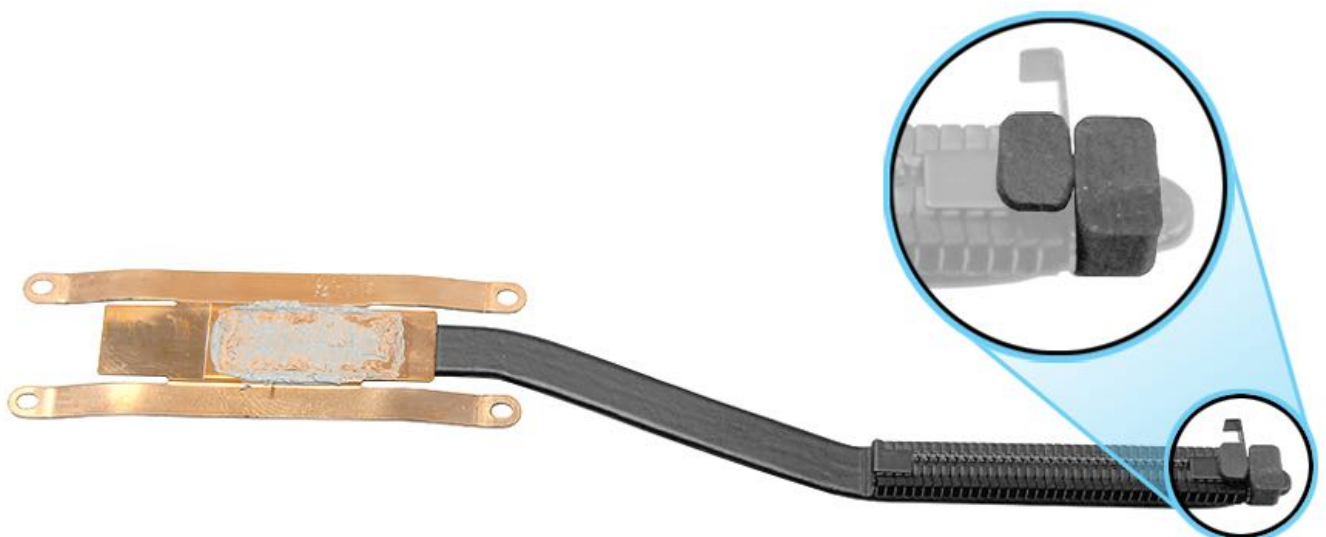


4. Make sure Mylar frame is centered over chip and covers tiny capacitors. Do not press too hard or capacitors may be damaged.

Mid 2011 and Mid 2012 Mylar frame examples:



5. For the Mid 2013, Early 2014, and Early 2015 models, check that two foam pads are adhered to the end of the heat sink arm.

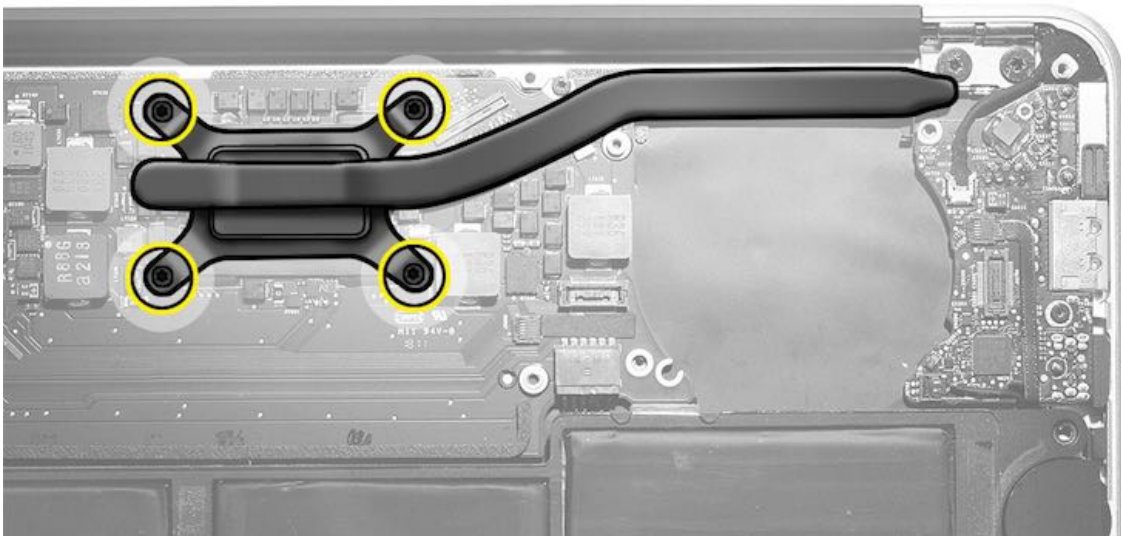


6. Lower heat sink over logic board.

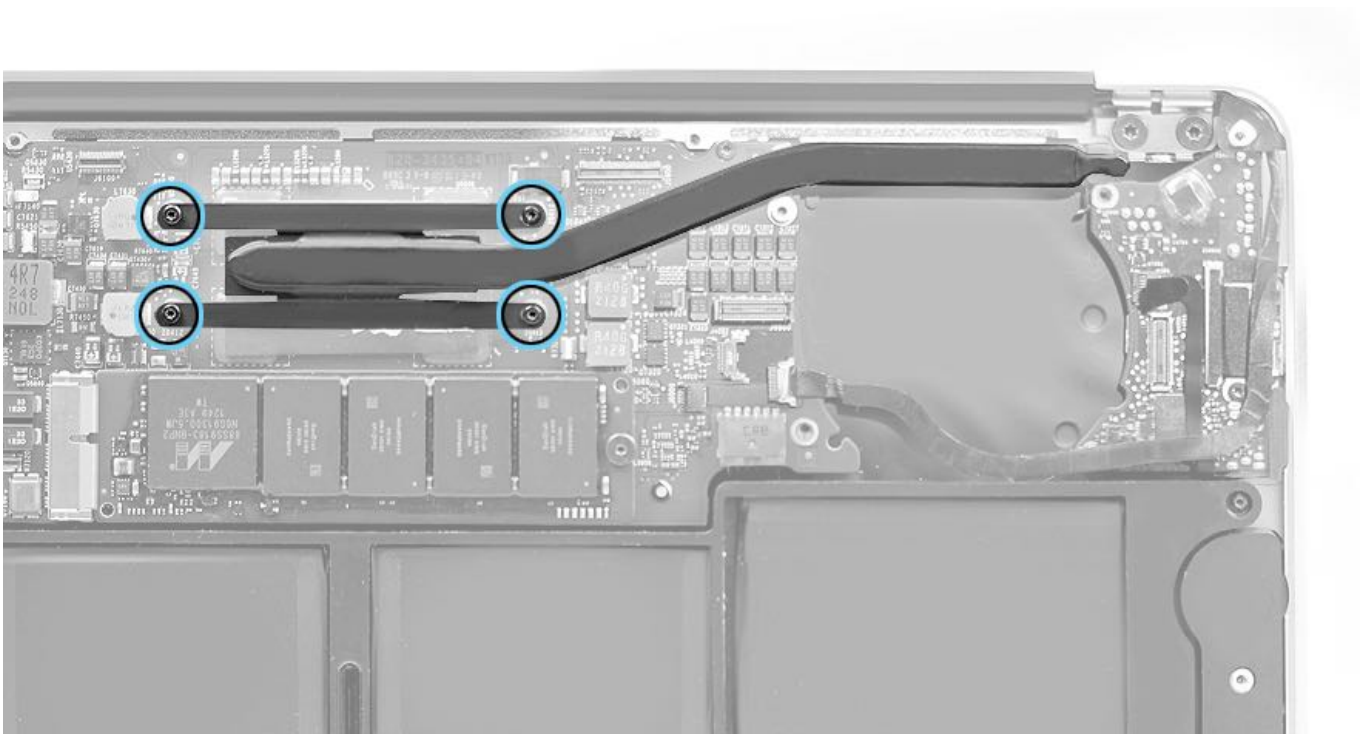
7. Install four Torx T5 screws: 922-9694 (2.53 mm) halfway first; then tighten.



Mid 2011 and Mid 2012



Mid 2013, Early 2014, and Early 2015



Logic Board

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT202594: Exams for Service Technicians](#).

For video instruction, refer to articles [SV199: Logic Board Replacement Video](#) (Mid 2012) or [SV181: Logic Board Replacement Video](#) (Mid 2013, Early 2014, and Early 2015).

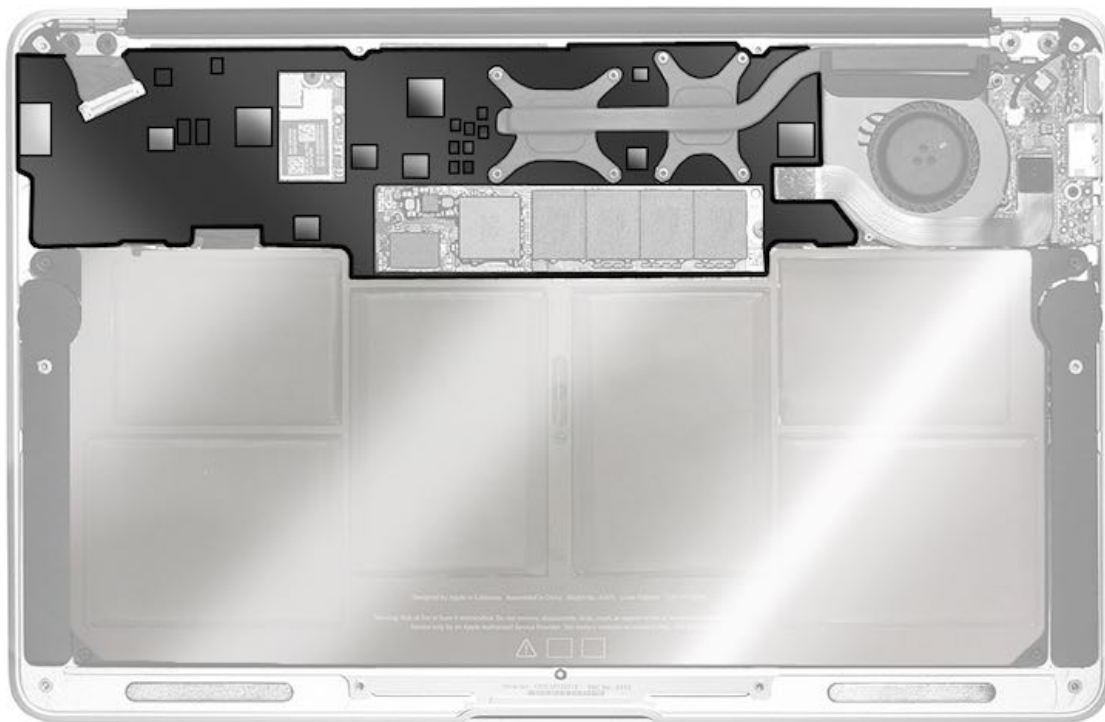
Remove:

- [Bottom Case](#)
- [Battery](#)
- [I/O Flex Cable](#)
- [SSD Card or Flash Storage](#)
- [AirPort/Bluetooth Card or Wireless Card](#) (Mid 2013, Early 2014, and Early 2015)
- [Fan](#) (Late 2010, Mid 2011, and Mid 2012)
- [Fan](#) (Mid 2013, Early 2014, and Early 2015)



Important: Immediately after removing the bottom case, always attach the battery cover and disconnect the battery cable from the logic board.

Caution: Read [Battery Safety Precautions](#) before beginning this procedure.



Tools

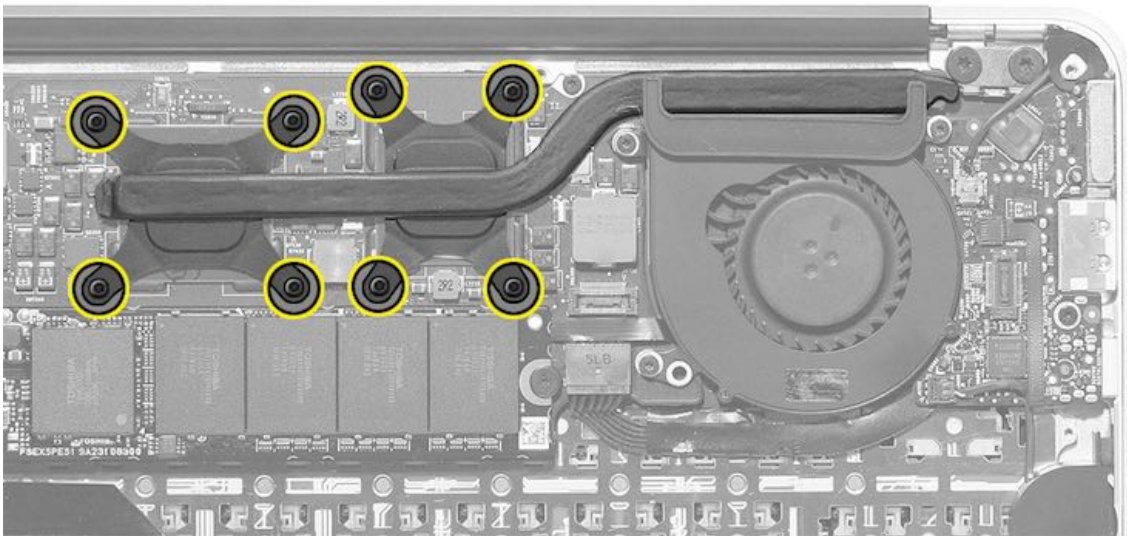
- ESD wrist strap
- Black stick
- Torx T5 screwdriver (magnetized)



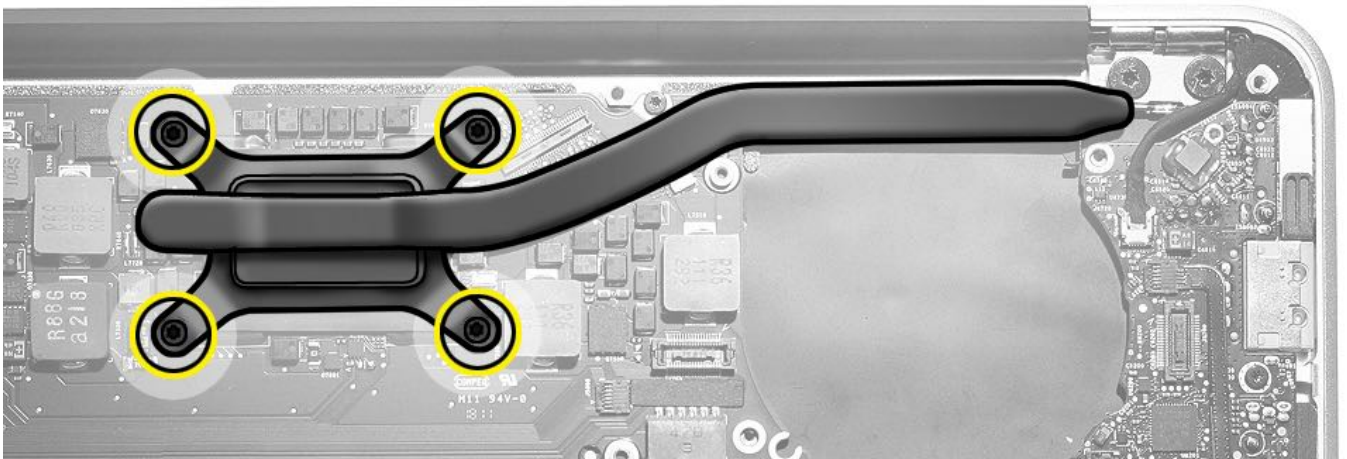
Steps For Removal

1. If a replacement logic board will be installed, transfer [heat sink](#) while logic board is in top case to avoid flexing board. If reinstalling the same logic board, do not remove heat sink and AirPort/Bluetooth or wireless card. Install heat sink on replacement logic board only after logic board is installed in top case.

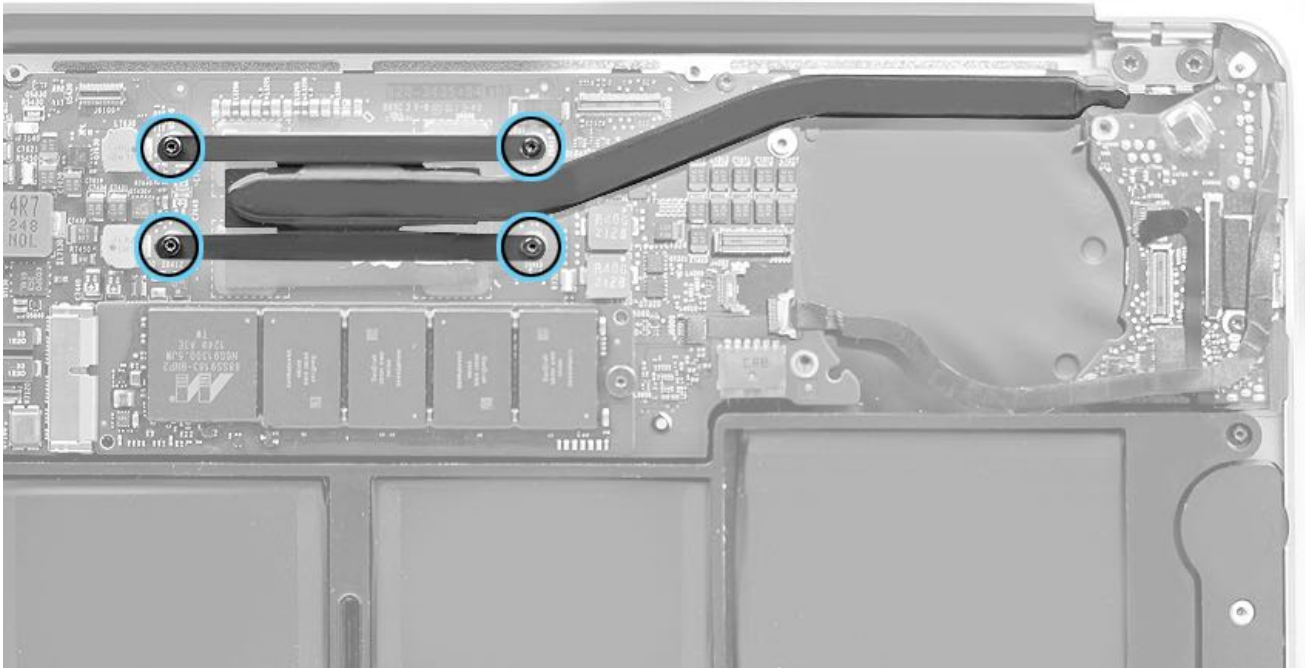
Late 2010



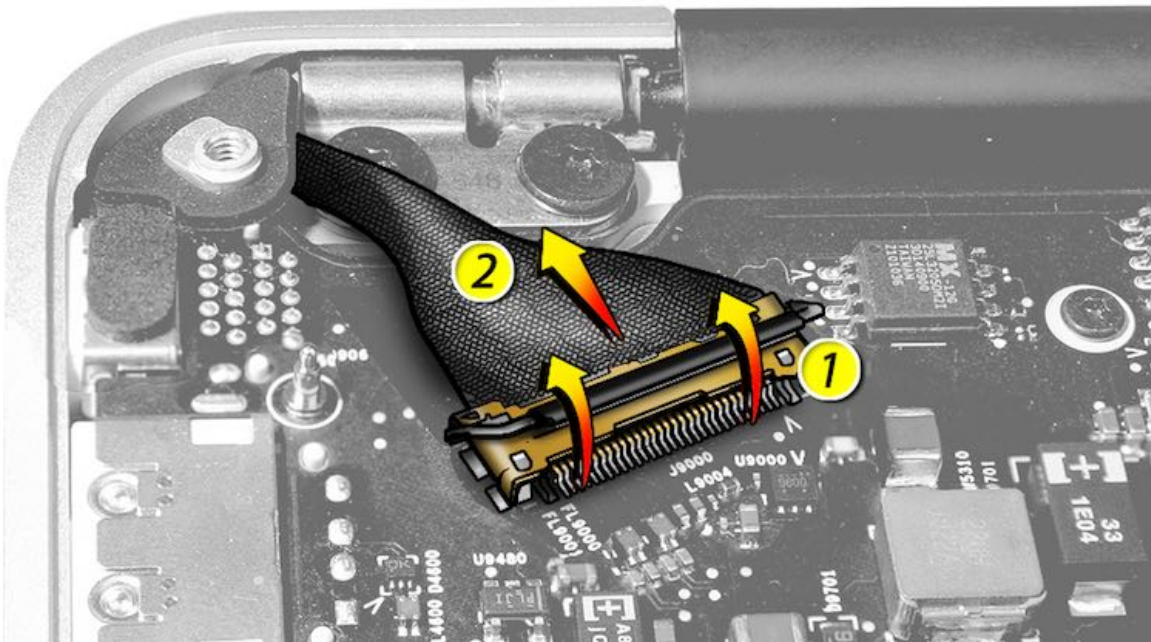
Mid 2011 and Mid 2012



Mid 2013, Early 2014, and Early 2015



2. Flip over lock bar before pulling to disconnect eDP cable. Do not use the bar as a handle.



3. Disconnect cables:

- input device (IPD)
- embedded DisplayPort (eDP)
- AirPort/Bluetooth antennas
- right speaker
- I/O power

Note: Be sure to unroute cables from notches in logic board.

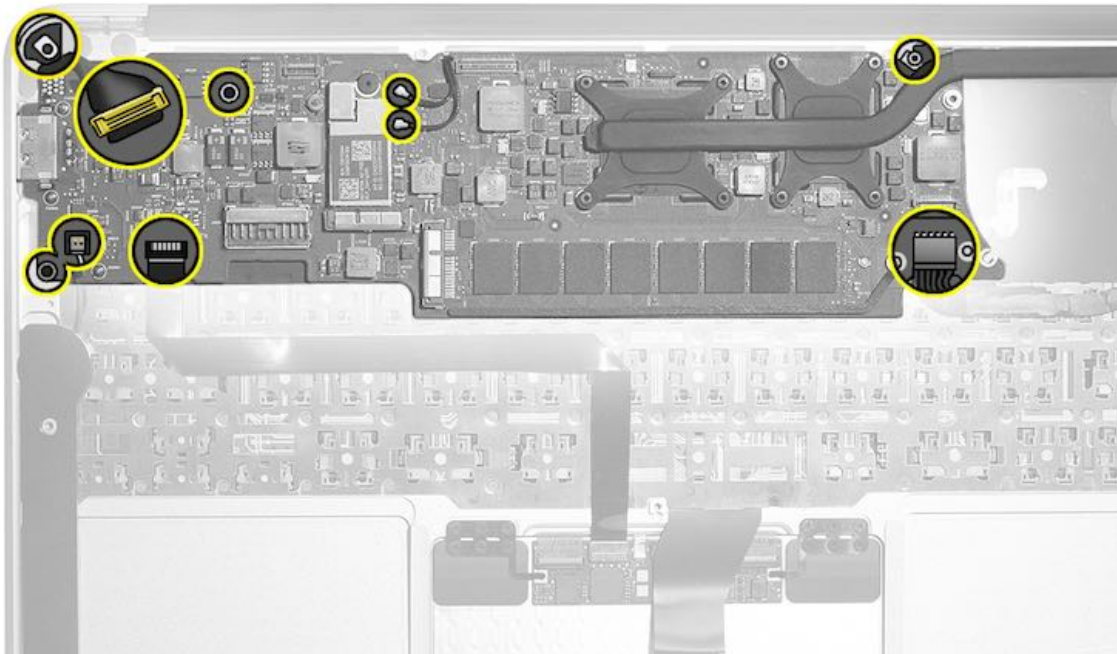
For **Mid 2011, Mid 2012, Mid 2013, Early 2014, and Early 2015 models**, disconnect all cables plus the keyboard backlight connector (shown in the next graphic).

Note: The locking lever cable connectors at keyboard flex cable (IPD), fan cable, and keyboard backlight cable are fragile. To protect levers during handling or shipment of logic board (whether a known-good or known-bad board), leave levers in the down position (closed) after cables are removed. Once logic board is back in top case and cables are installed, be sure to lock down levers.

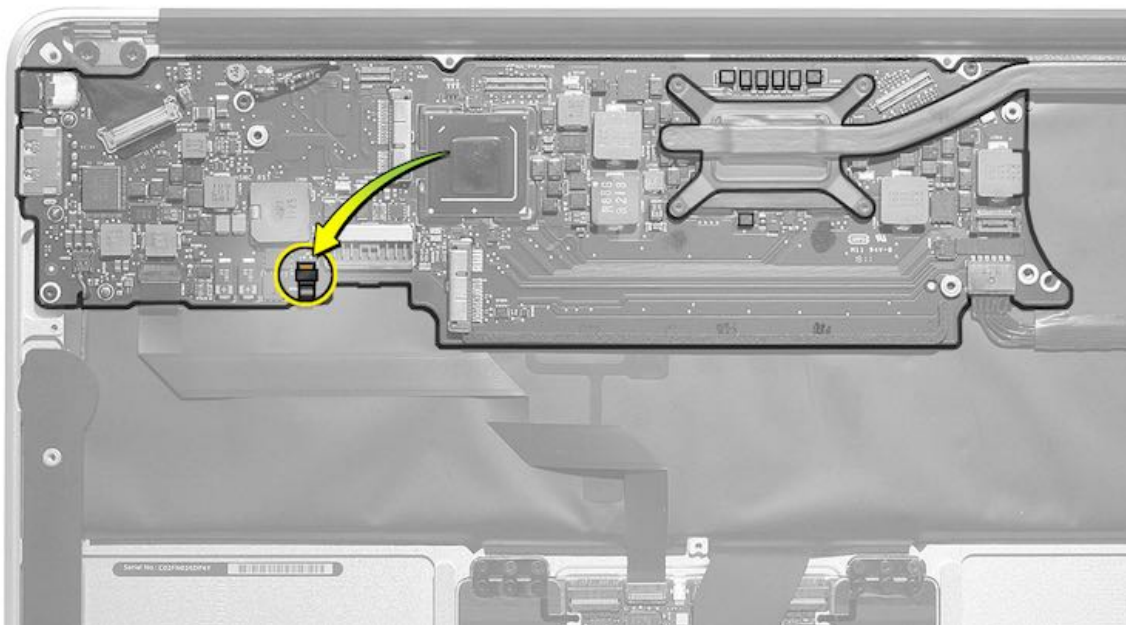
4. Remove three Torx T5 screws: 922-9692 (3.62 mm)



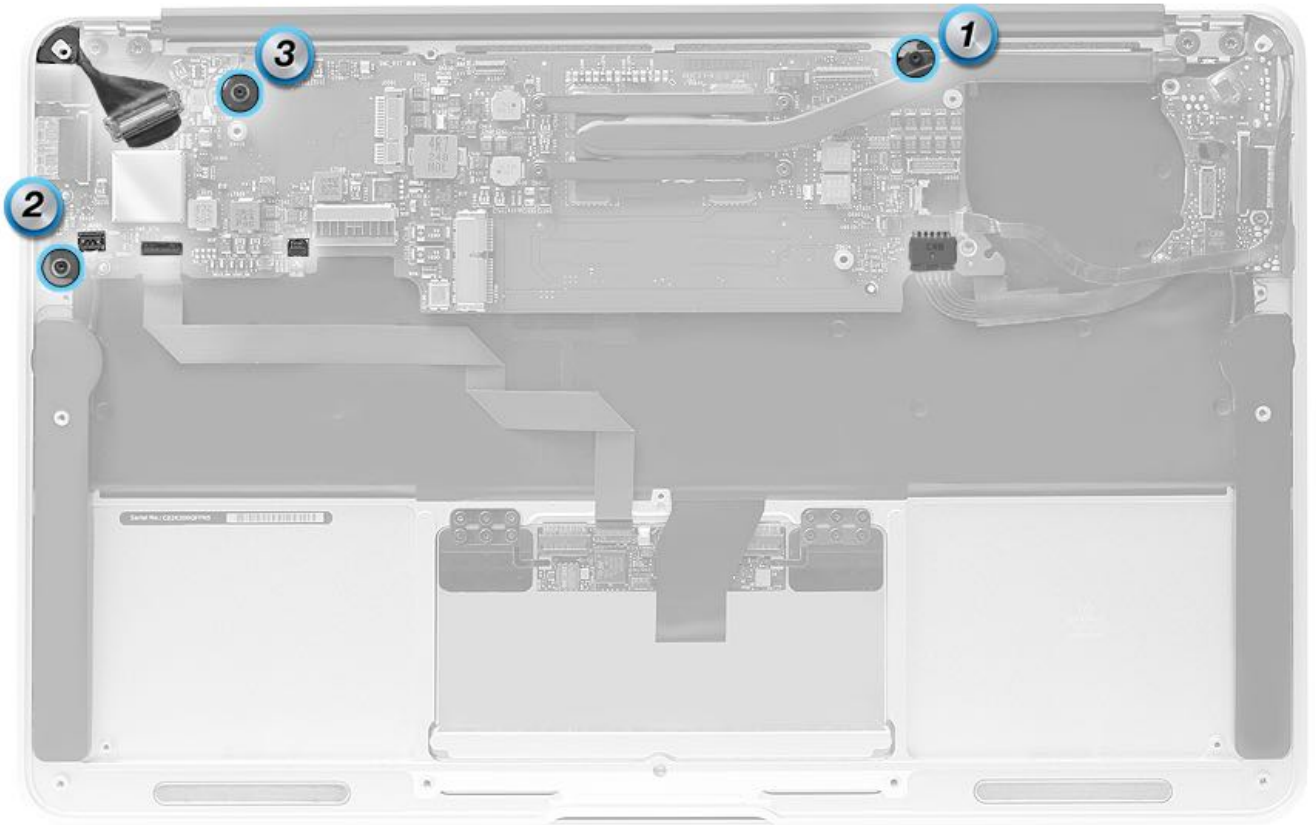
Late 2010



Mid 2011 and Mid 2012

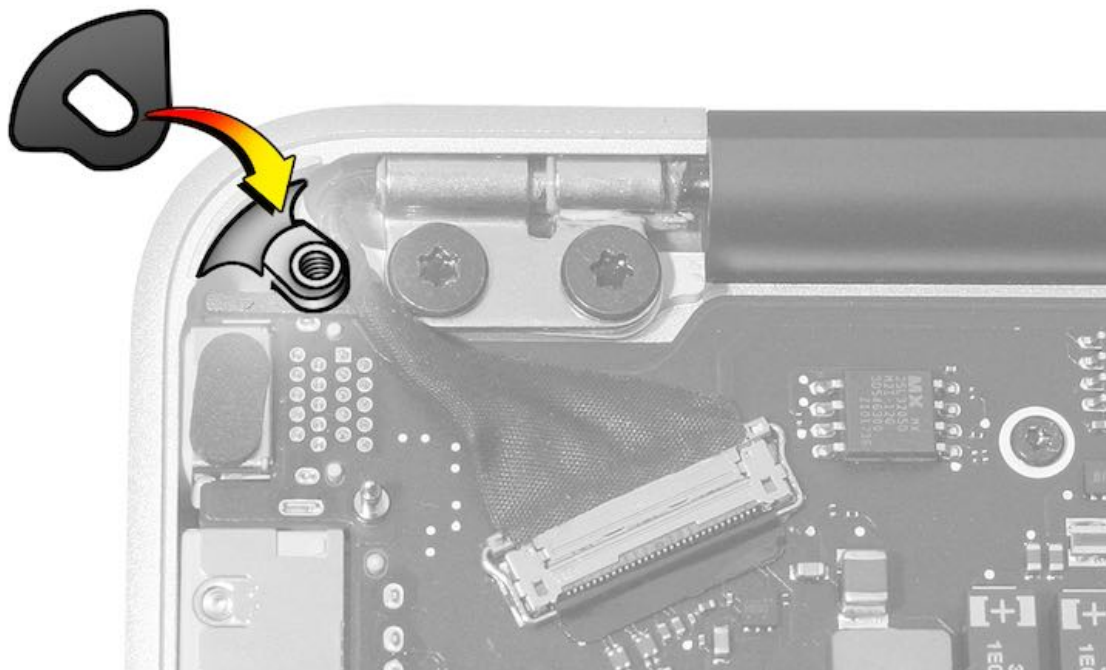


Mid 2013, Early 2014, and Early 2015

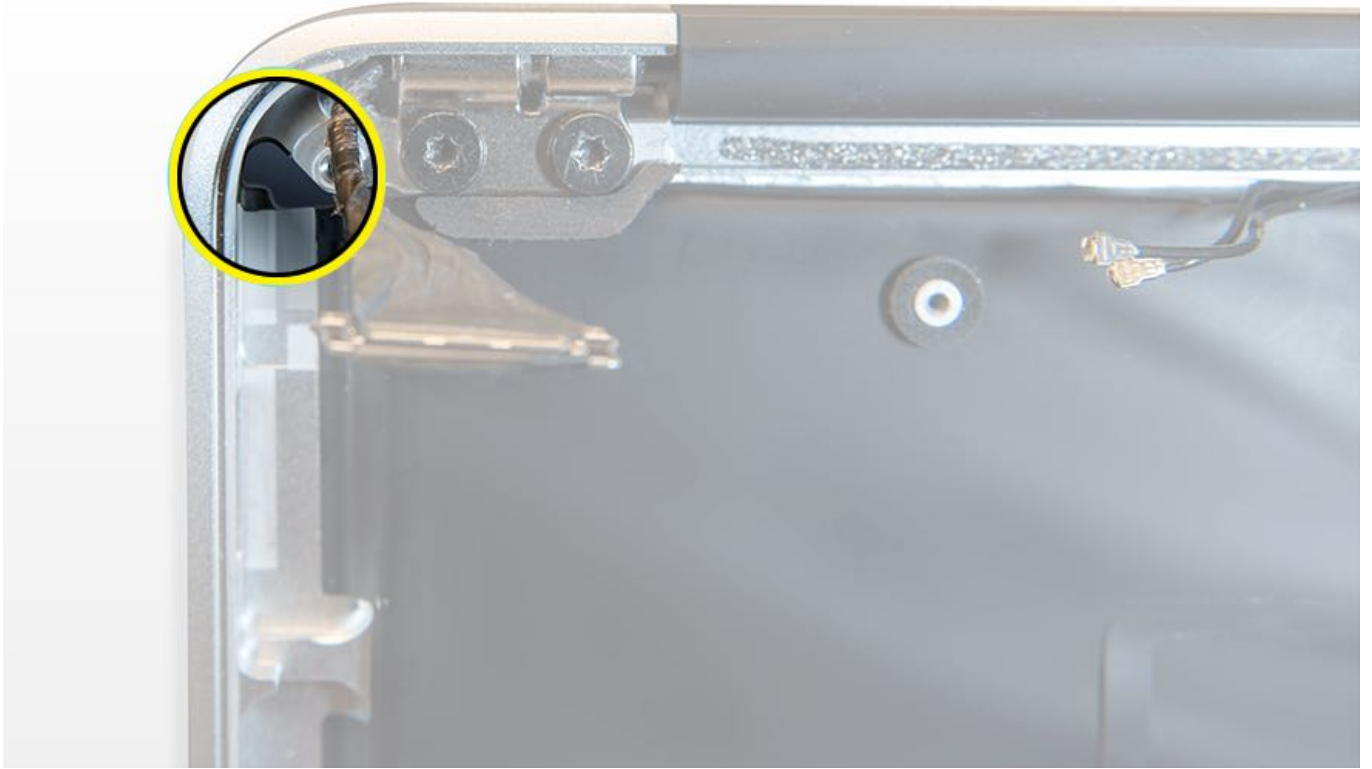


5. Remove wedge-shaped rubber gasket (922-9698) from corner of top case.

Replacement Note: Insert rubber gasket as shown. The gasket shape is unique for each rear corner.

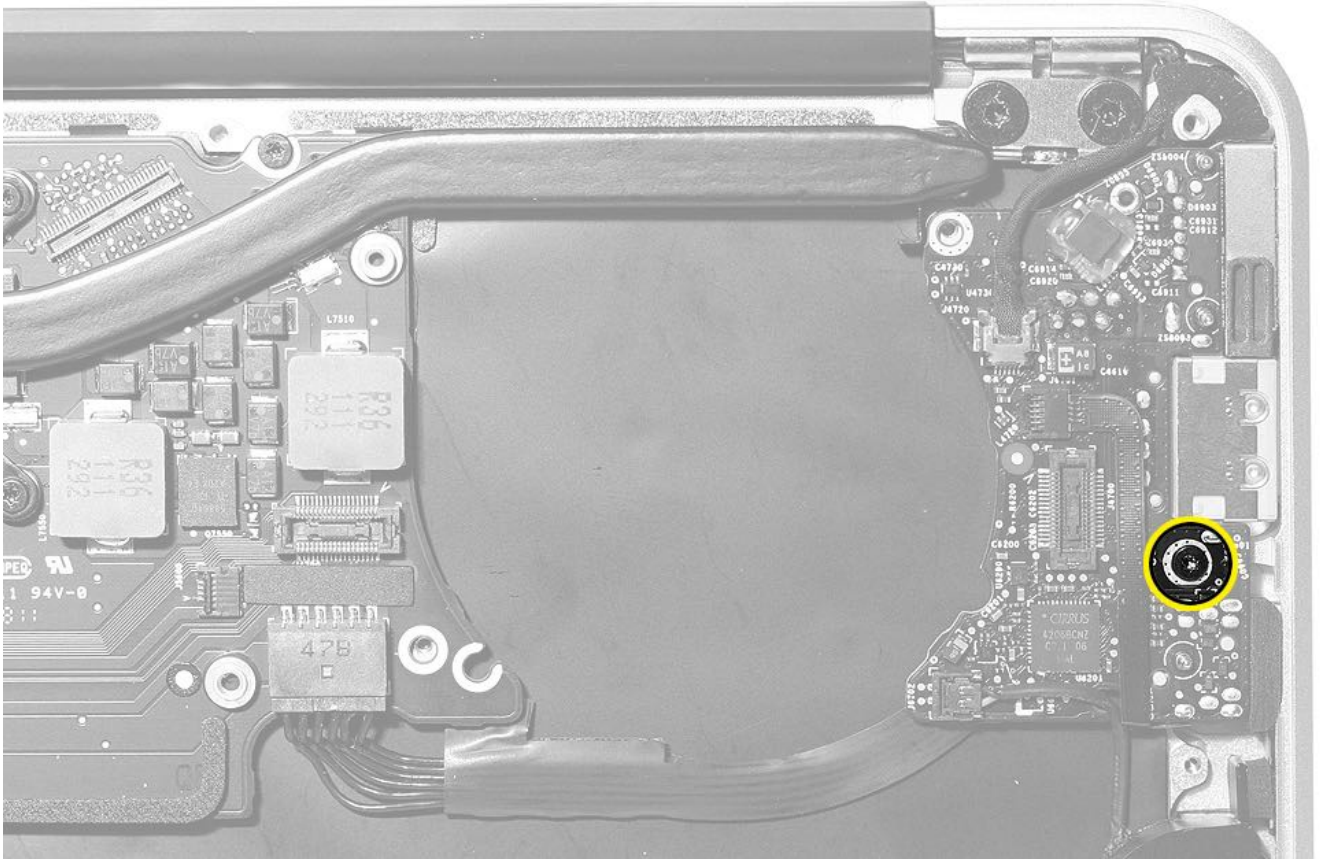


Replacement Note: The Mid 2012, Mid 2013, Early 2014, and Early 2015 models include a rubber bumper adhered to the inside of the top case. Check that the rubber bumper is in place in top case before inserting logic board. A new rubber bumper is included with replacement top case.



6. Important note for Mid 2011 and Mid 2012 models: To prevent strain on the logic board, remove the Torx T5 (3.62 mm) I/O board screw (922-9692). This allows easier access to the heat sink arm when maneuvering that end of the logic board. Reinstall the I/O board screw after the logic board is in place.





7. Note the differences in board removal.

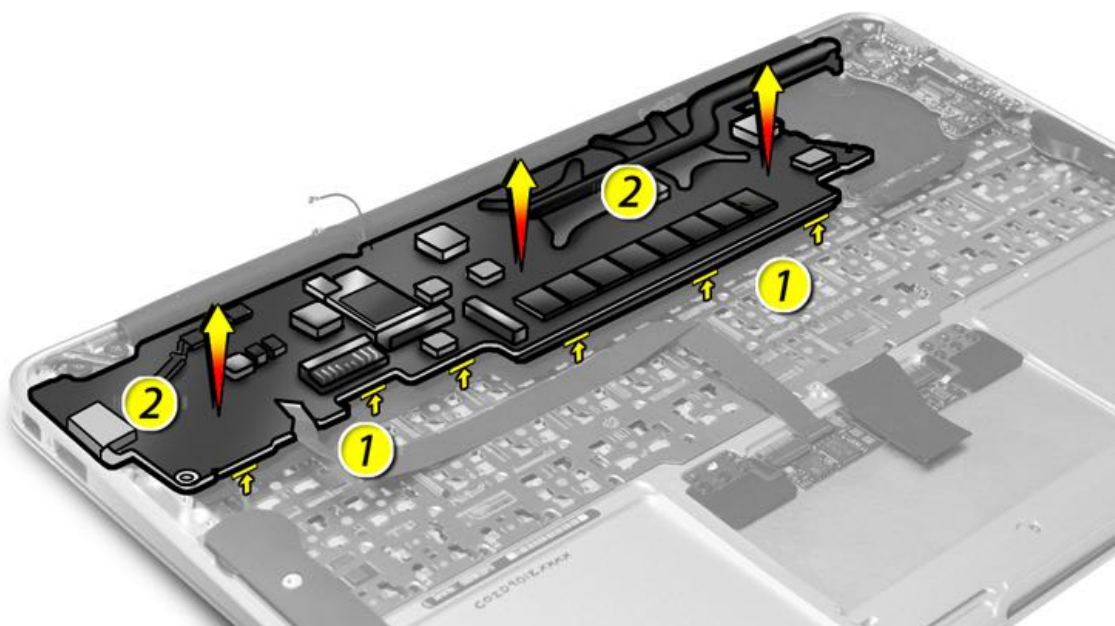
Important: If returning board to Apple, ensure that all locking levers are in closed (flipped down) position.

Caution: Follow safe handling:

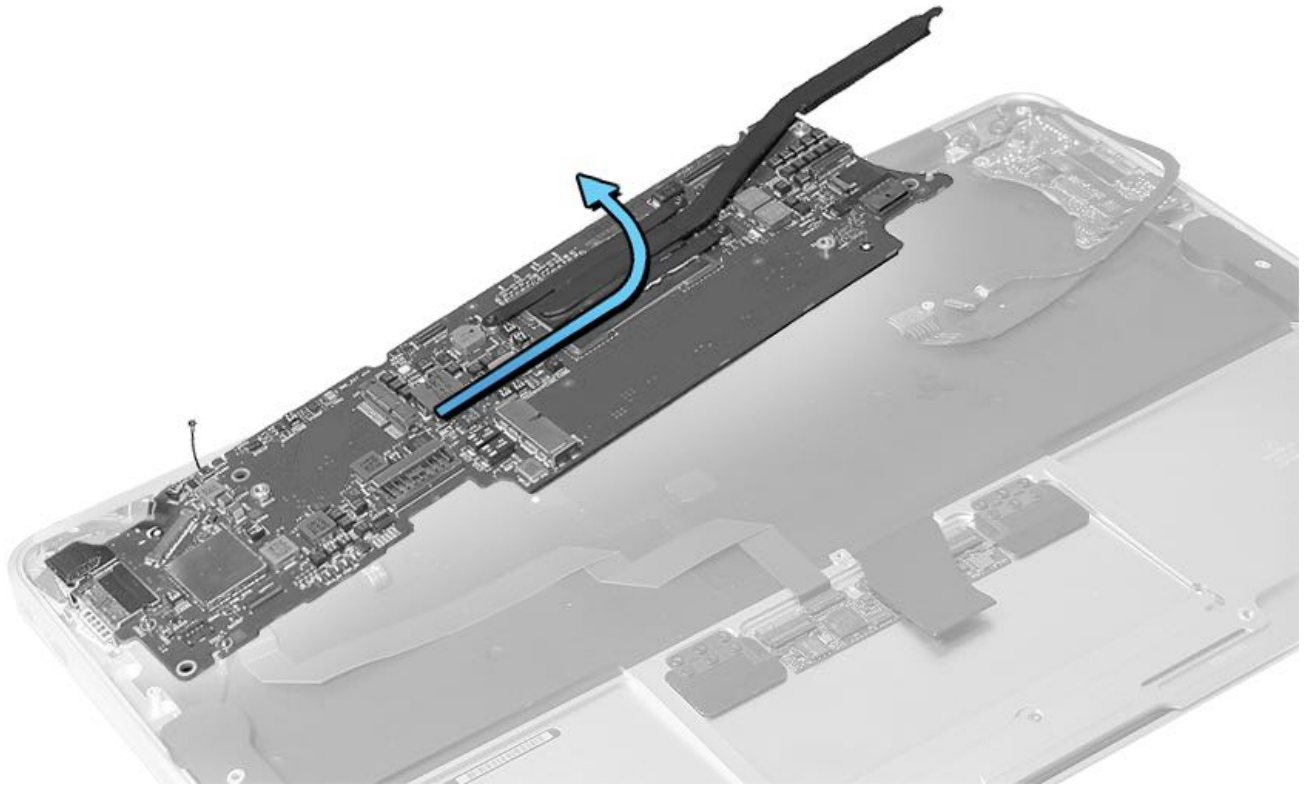
- Hold logic board by edges.
- Do not touch heat sink or connectors.
- Do not touch circuitry.

Reassembly Caution: Ensure that cables are not pinched.

Late 2010, Mid 2011, and Mid 2012: Tip up front edge of logic board and lift board straight up. **Tilting the board is important to prevent connector damage.**

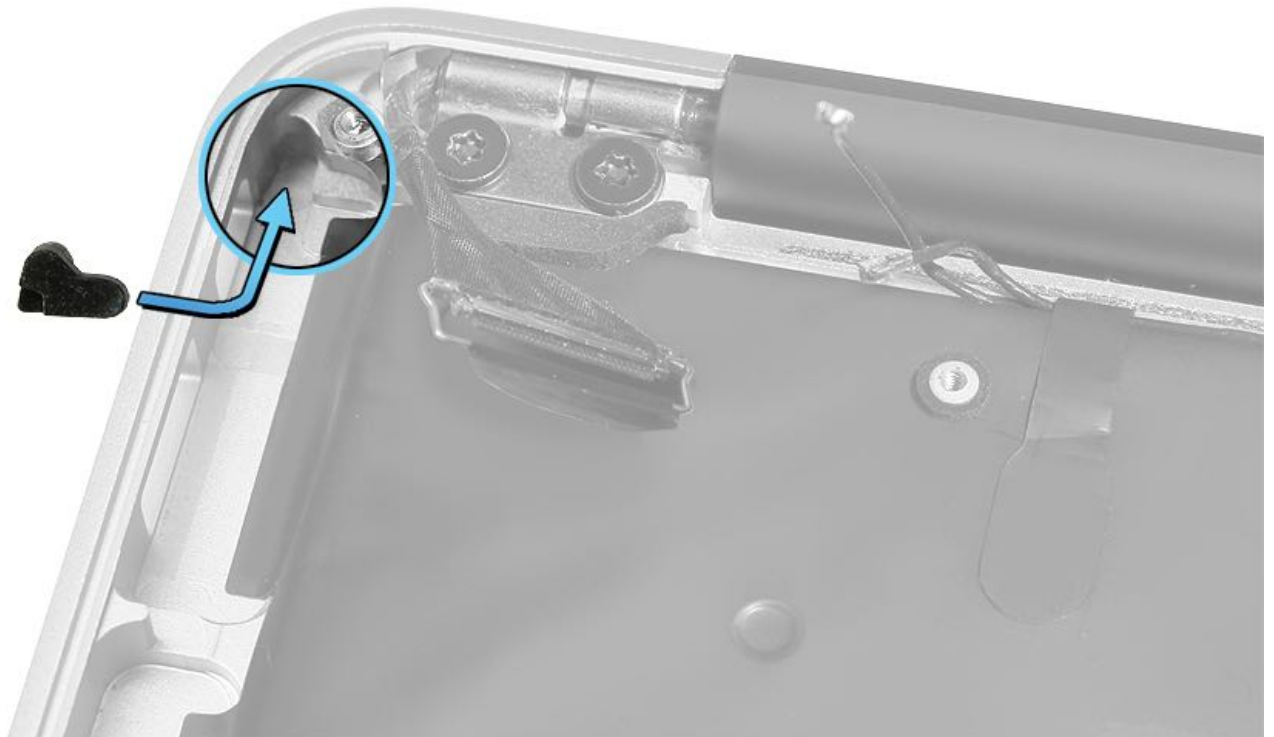


Mid 2013, Early 2014, and Early 2015: Holding board by edges, pivot it out of top case.



Steps For Reassembly

1. Check that the rubber bumper is adhered in the corner of the top case.

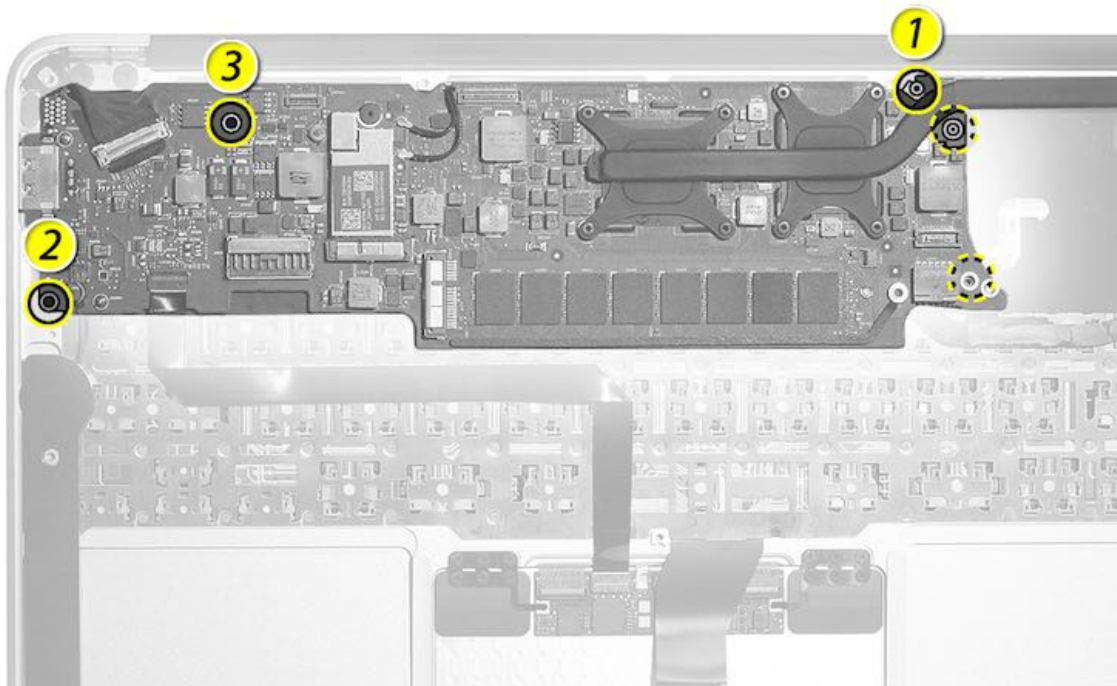


2. Place logic board into top case and slide it toward ports. Align connector and screw holes with openings in top case.

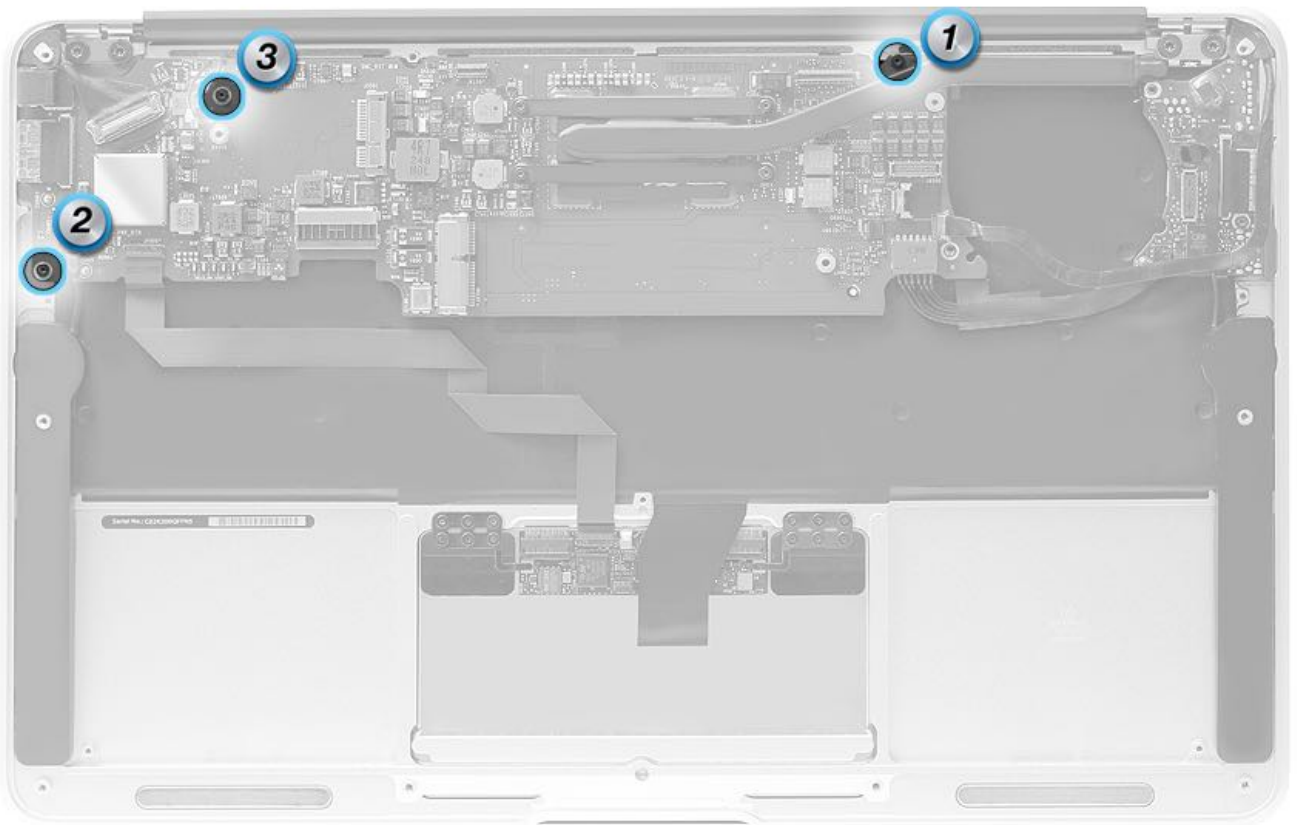
Caution: Ensure that cables are not pinched.

3. Loosely install screws, correct for alignment with fan screw holes, then secure logic board screws in order shown.

Late 2010, Mid 2011, and Mid 2012

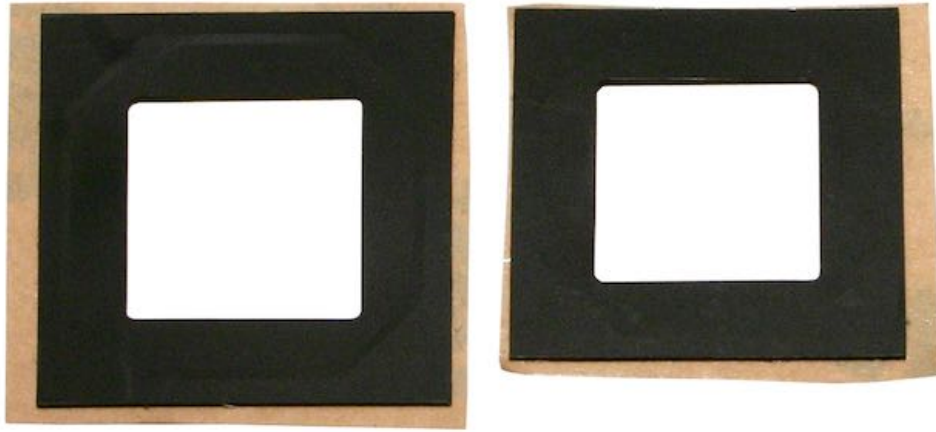


Mid 2013, Early 2014, and Early 2015

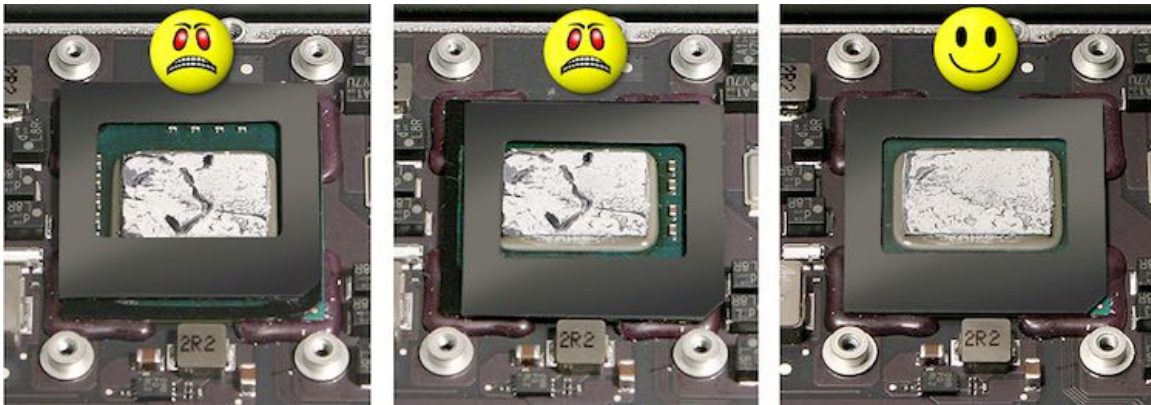


4. Reconnect cables.

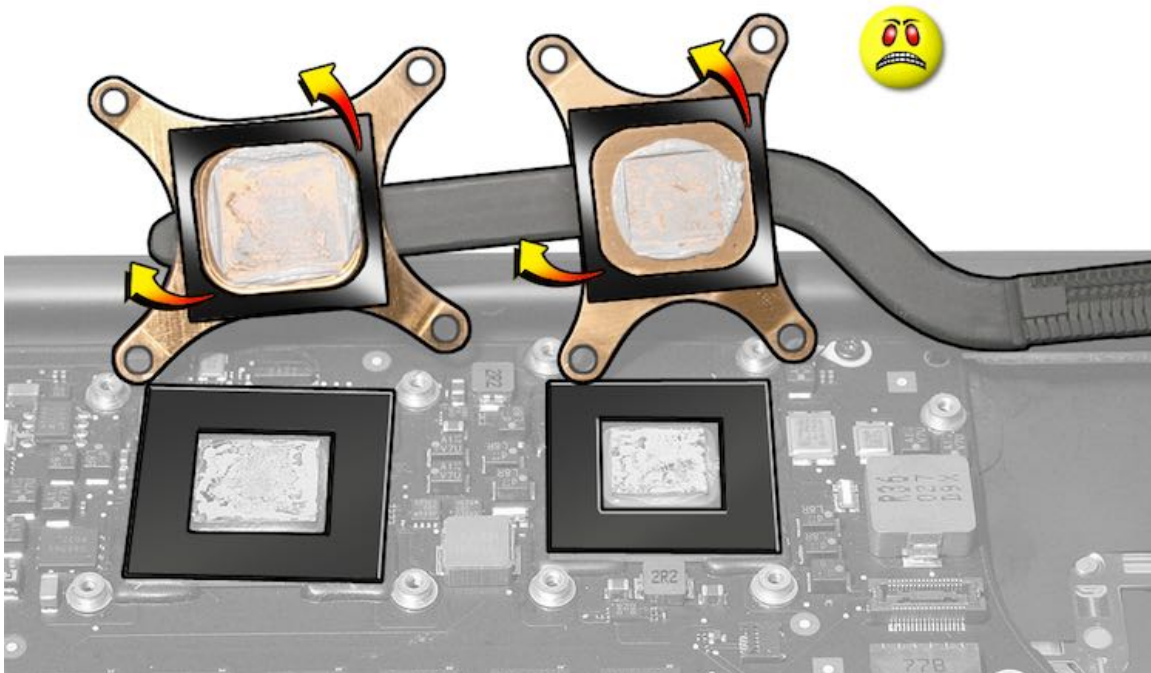
5. If a replacement logic board will be installed, verify that the replacement logic board has Mylar frames on Media Core Processor (MCP) and CPU chips.



6. If you need to install them, ensure that the Mylar frame is centered over chip and covers tiny capacitors. Do not press too hard or capacitors may be damaged.

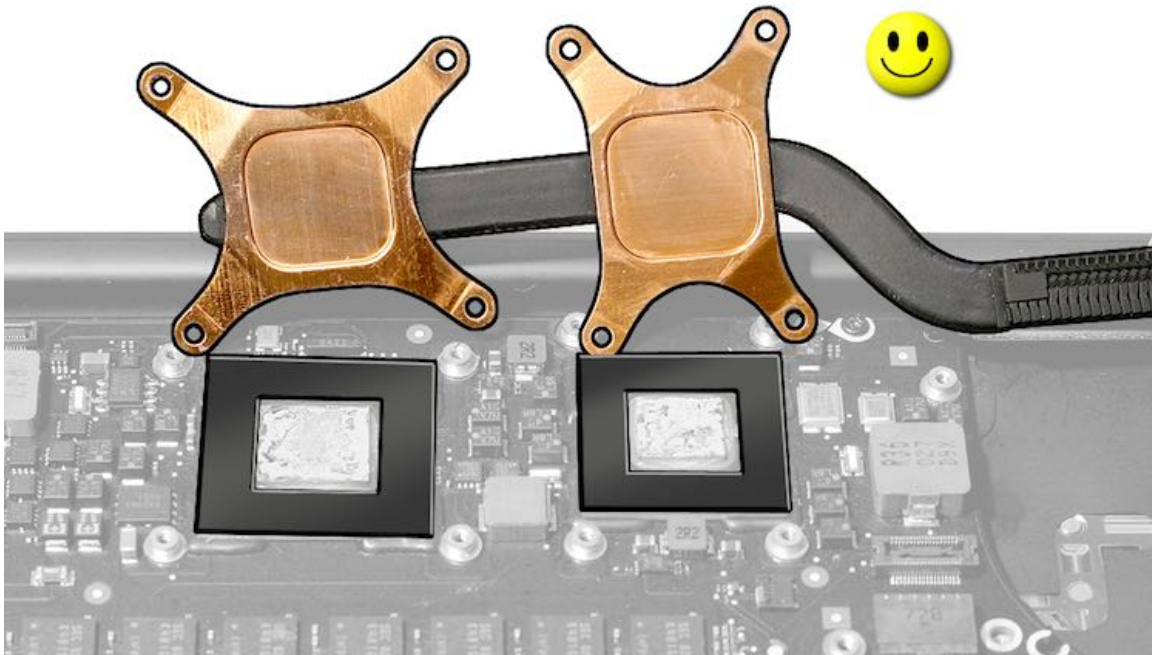


7. If Mylar frames are on heat sink, use a black stick to remove the Mylar.

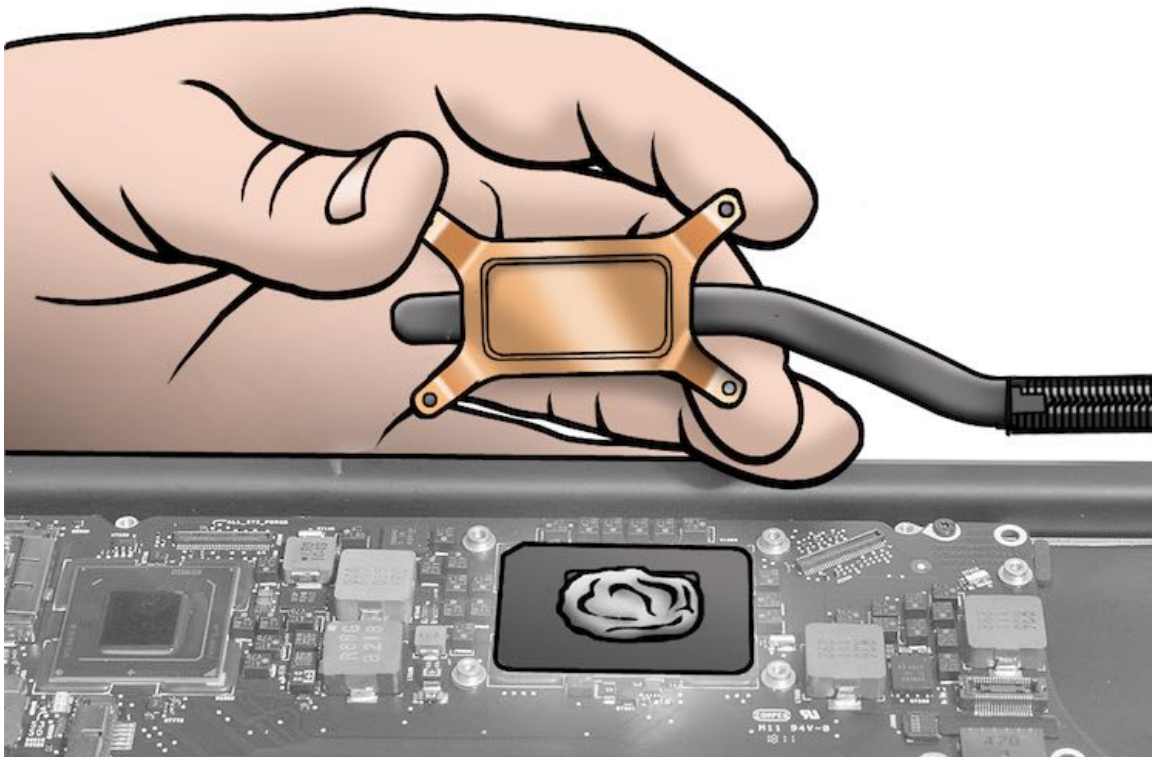


8. Clean heat sink, apply thermal grease to the chip(s), and replace heat sink.

Late 2010



Mid 2011 and Mid 2012



Mid 2013, Early 2014, and Early 2015

Important: For the Mid 2013, Early 2014, and Early 2015 models, place the thermal grease in a two-dot pattern on the long chip. Ensure that thermal grease is applied only to the long chip, not to the clean chip to the left.



If installing a new replacement logic board:

9. Run Blank Board Serializer (BBS) to set the computer's serial number to the new logic board. BBS can be run from AST 1 or AST 2, or as a stand-alone, USB-based version found in article [SD63: Blank Board Serializer](#).

Note: When using Blank Board Serializer in AST 1 or AST 2, ensure that the unit under test (UUT) and the AST server are connected to the same network, and that the AST server has the latest software version installed.

10. Run the Mac BootROM Updater to ensure the replacement logic board's EFI BootROM firmware is updated to the latest version that supports the APFS file system.

Caution: Some Macs that have been updated to macOS High Sierra may not start up to the internal startup volume after a logic board replacement. On affected Macs, the Mac BootROM Updater is available to address this issue. This utility updates the EFI BootROM on affected Macs to allow starting up to a volume that has been updated to the APFS file system.

For more information about AST and AST 2, supported Mac models, and instructions for downloading and using these utilities, see article [OP476: Latest Apple Service Toolkit download links and documentation](#).

Trackpad

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT202594: Exams for Service Technicians](#).

Remove:

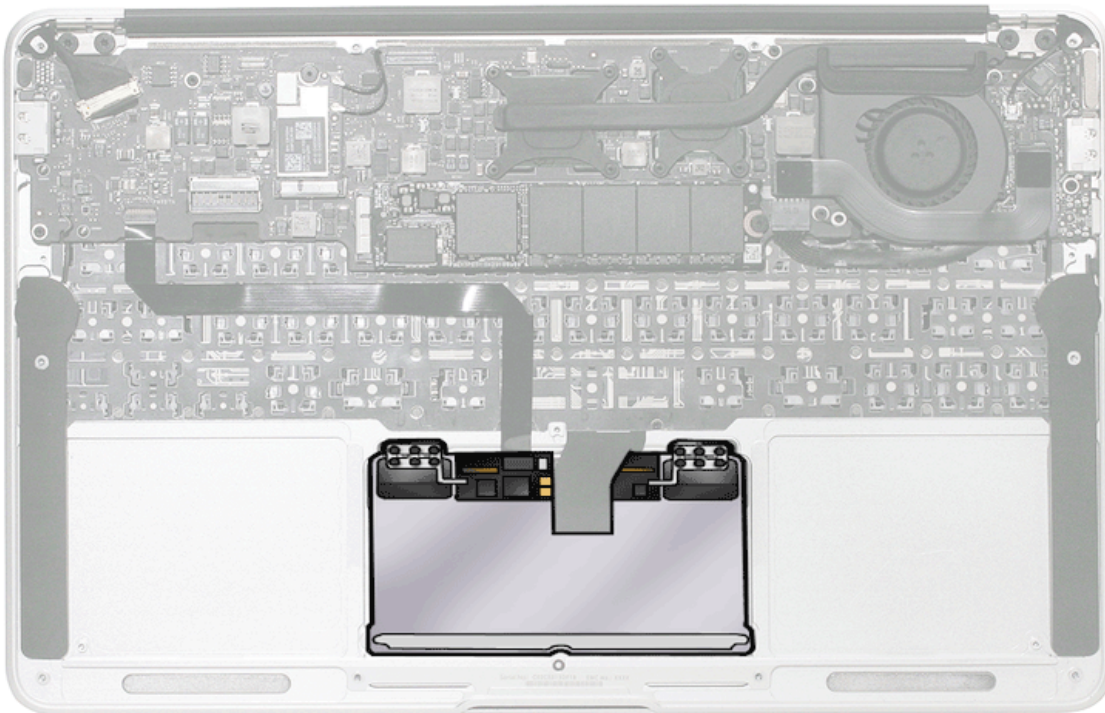
- [Bottom Case](#)
- [Battery](#)



Important: Immediately after removing the bottom case, always attach the battery cover and disconnect the battery cable from the logic board.

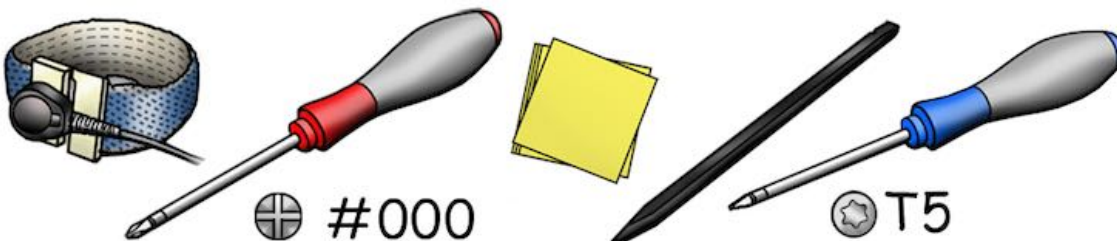
Caution: Read [Battery Safety Precautions](#) before beginning this procedure.

Important: After replacing a Mid 2013, Early 2014, or Early 2015 trackpad, Trackpad Keyboard Mapper must be used to ensure trackpad is coded to match keyboard version. For more information, refer to article [TP1016: AST Reference Guide: Using the Trackpad Keyboard Mapper](#).



Tools

- ESD wrist strap
- Phillips #000 screwdriver, magnetized
- Sticky (Post-it) notes
- Black stick
- Torx T5 screwdriver

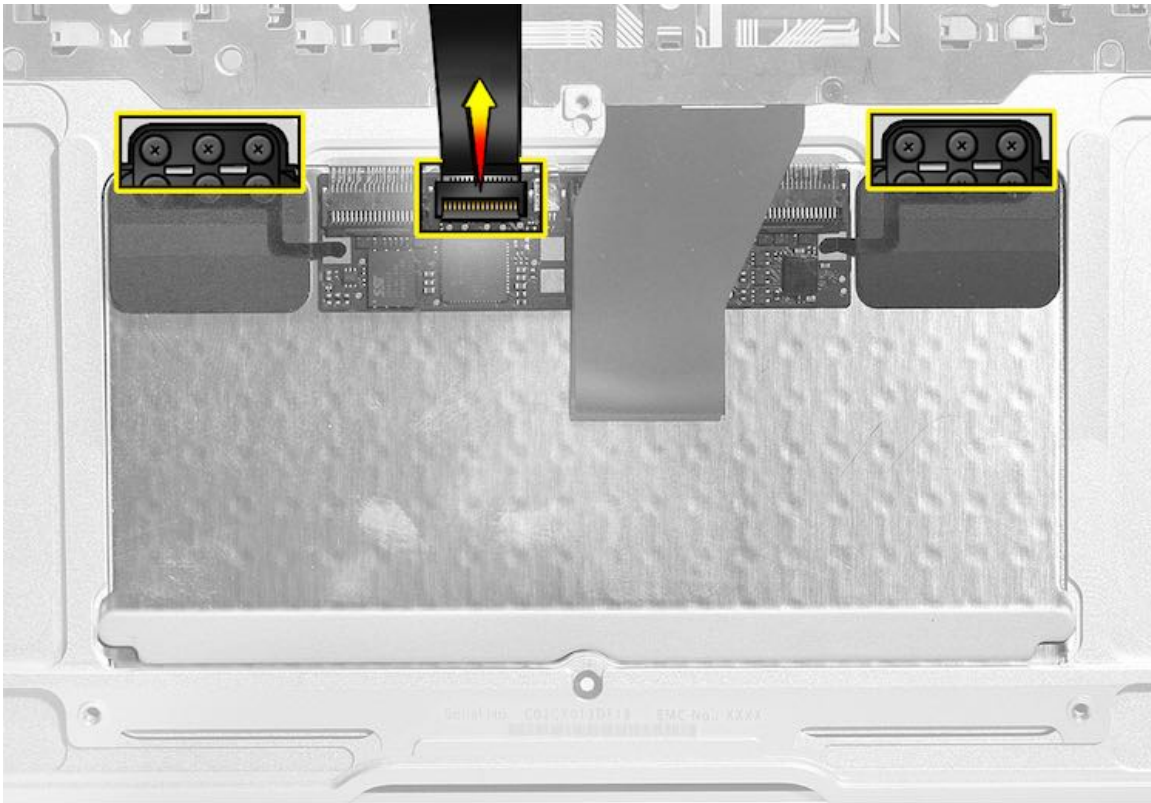


Trackpad kit 922-9670 includes:

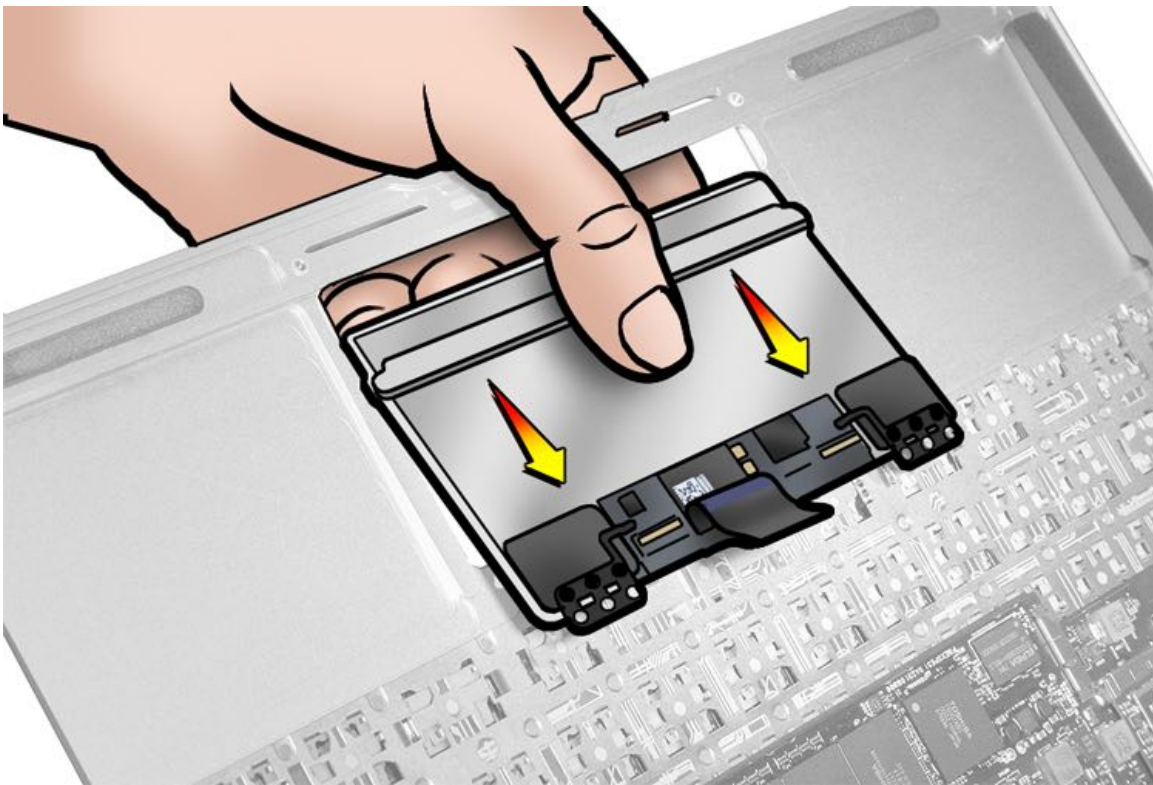
- trackpad
- two (2) metal flexures
- flexure screws
- set screw

Steps For Removal

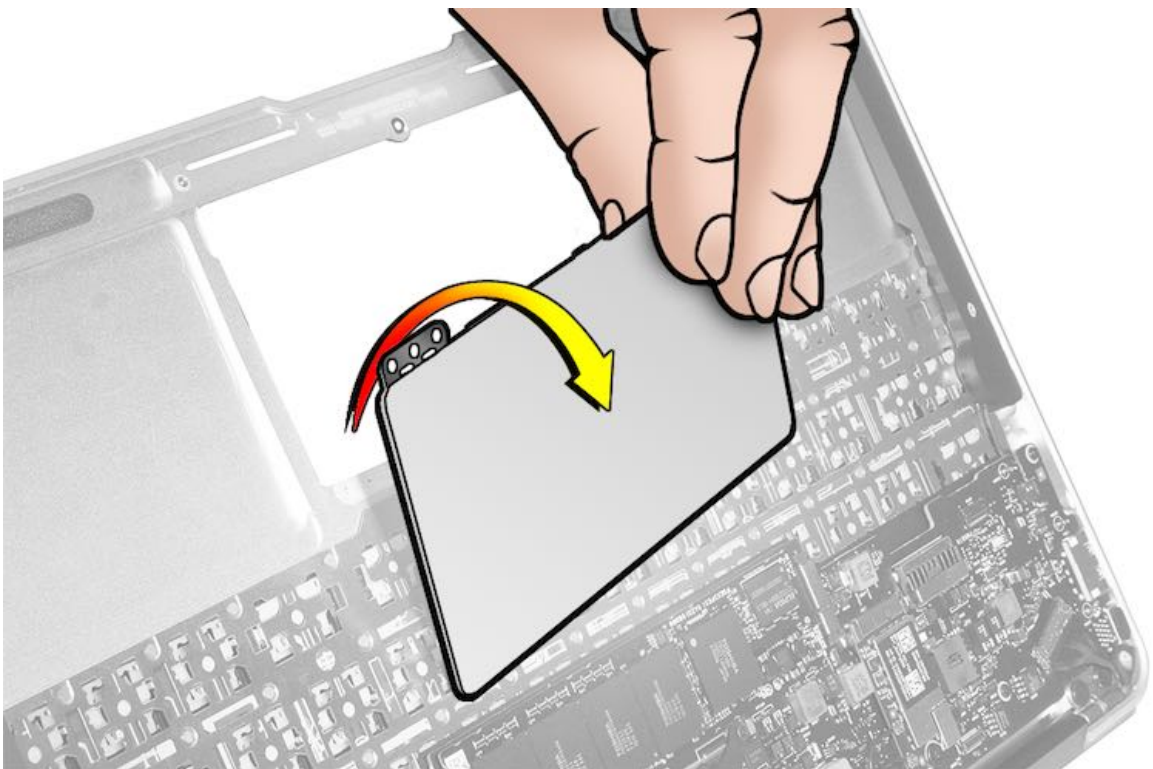
1. Place protective cloth over display.
2. Flip up locking lever to disconnect IPD cable from trackpad. Pull cable toward keyboard.
3. Remove six Phillips #000 screws, 922-9255 (1.47 mm), from flexures (three screws on top row of flexures). Discard screws.



4. With keyboard flex cable still connected, lift top case up and push trackpad toward keyboard until bottom lip of trackpad clears top case.



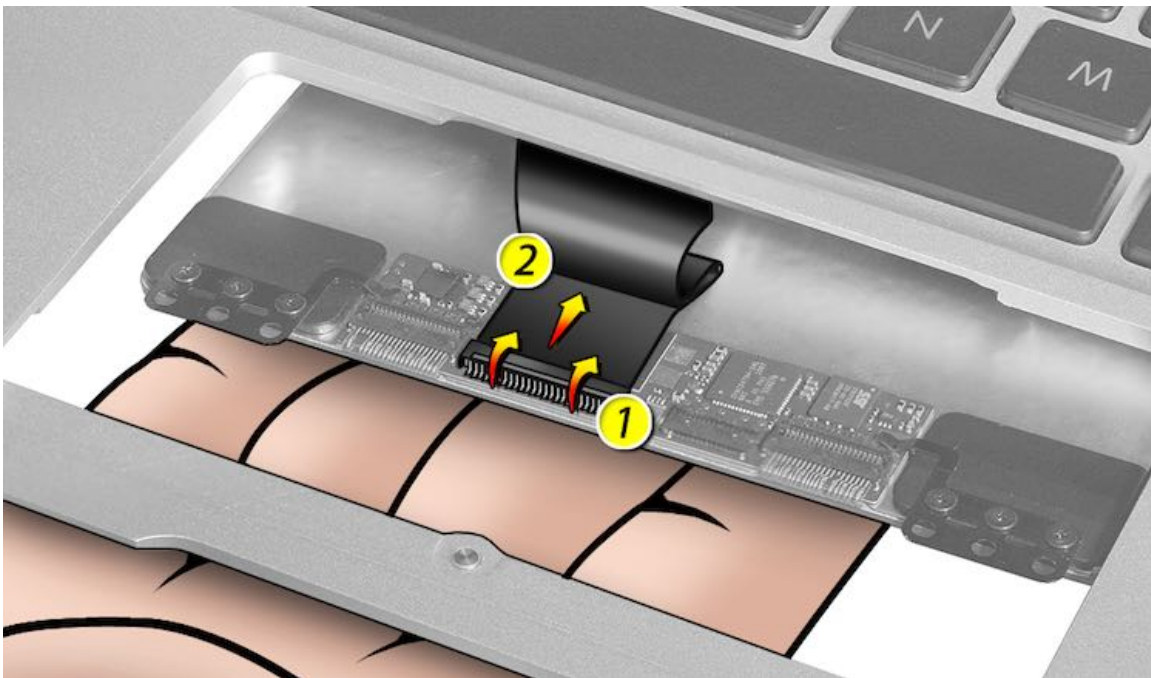
5. Without straining flex cable, support the trackpad while turning it over.



6. Tilt up top case to access cable from other side, or place computer assembly on its right side with an open display.

7. Flip up locking lever to disconnect keyboard flex cable from trackpad.

Tilt up top case to access keyboard flex cable, or...



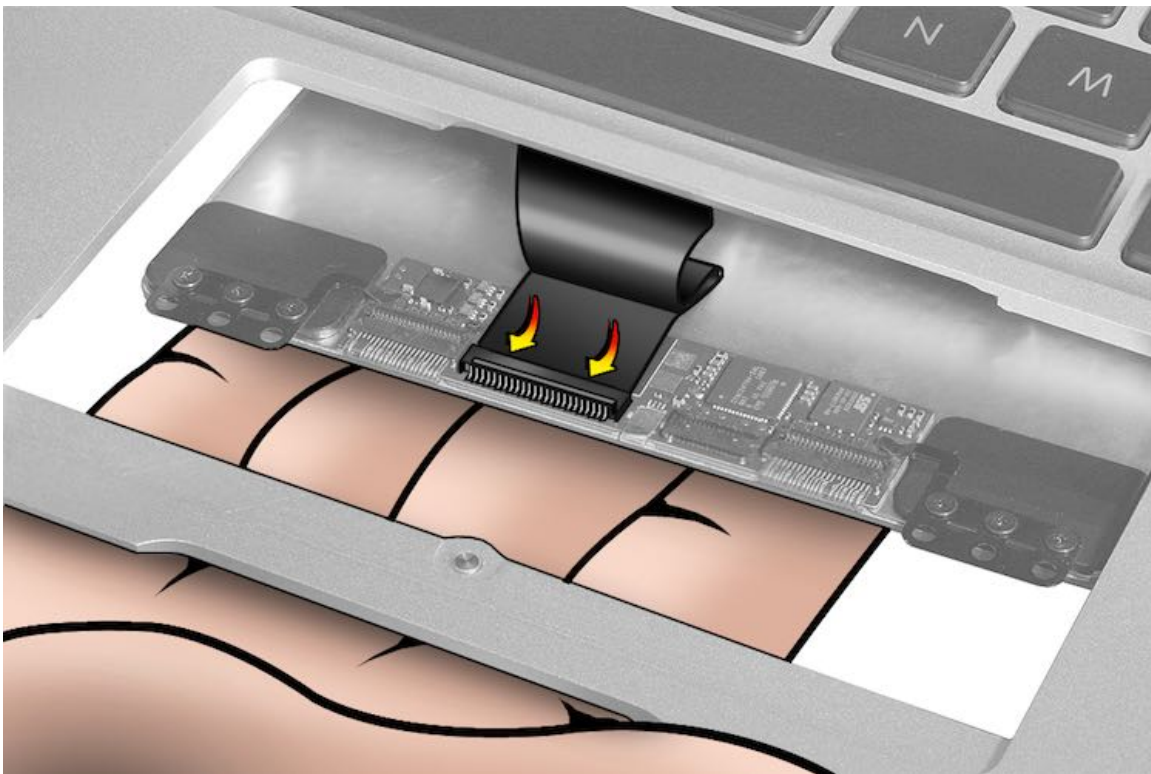
Place computer on right side to access keyboard flex cable.



Steps For Reassembly

1. Connect keyboard flex cable to trackpad and verify cable is seated properly before locking lever.

Tilt up top case to connect keyboard flex cable, or...

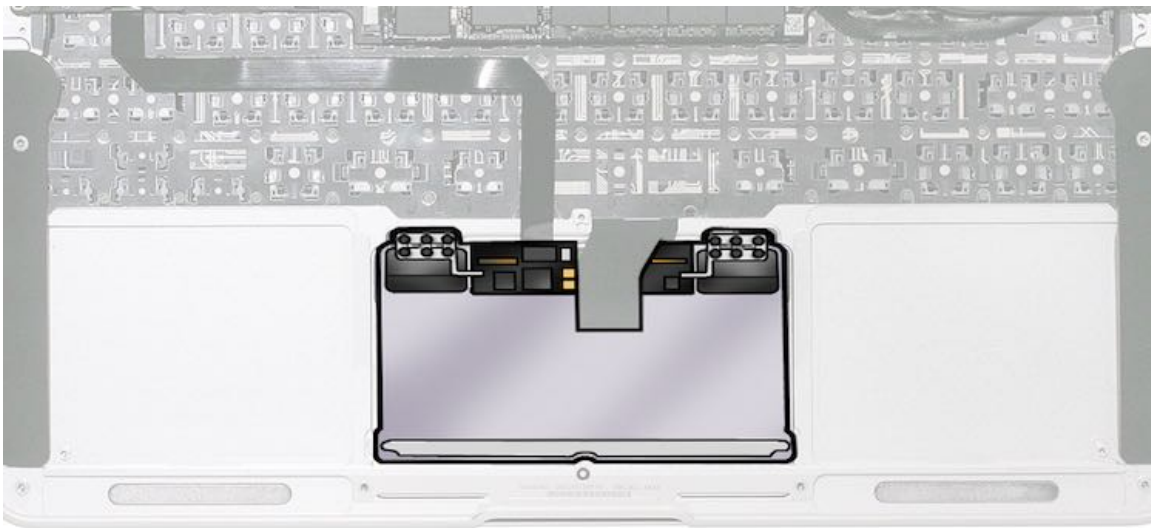


Place computer on right side to connect keyboard flex cable.



2. Check keyboard flex cable connection to trackpad.

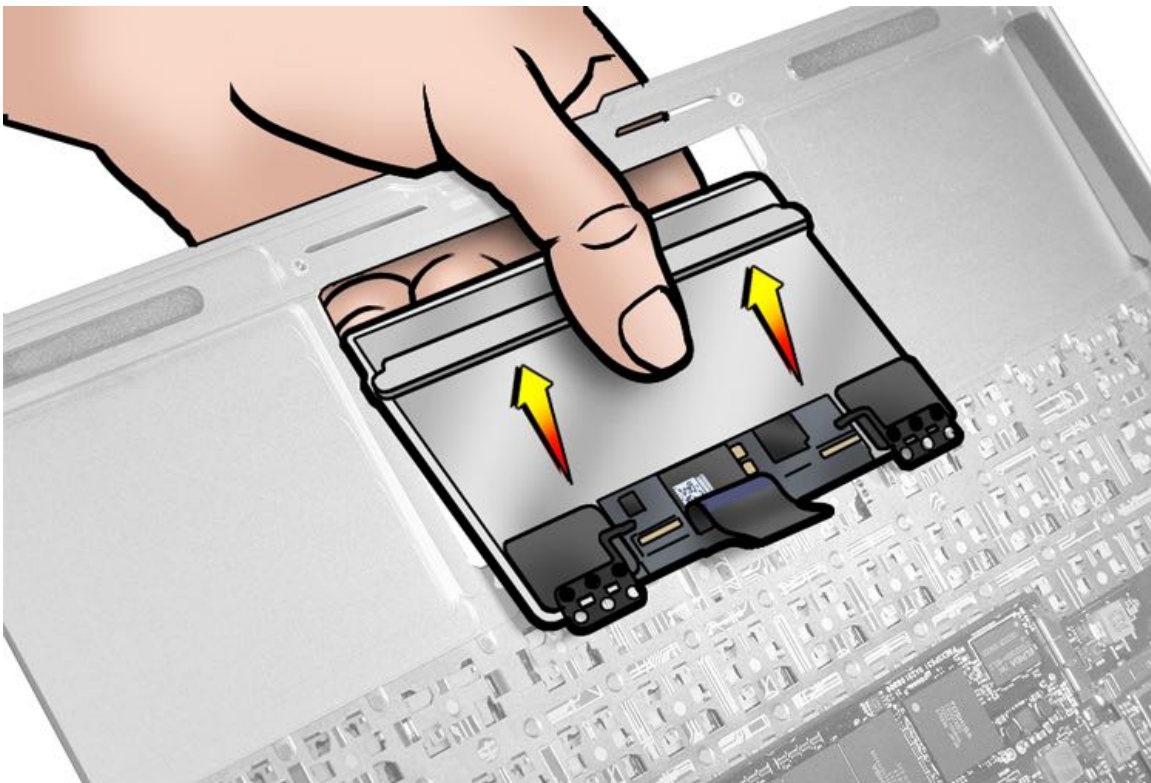
Important: Keyboard flex cable MUST lay flat against trackpad. Very high bond (VHB) adhesive holds bend in cable. If VHB adhesive or cable are compromised, trackpad alignment issues may occur. This may necessitate top case replacement.



3. Rotate trackpad (bottom lip first) into top case.

Caution:

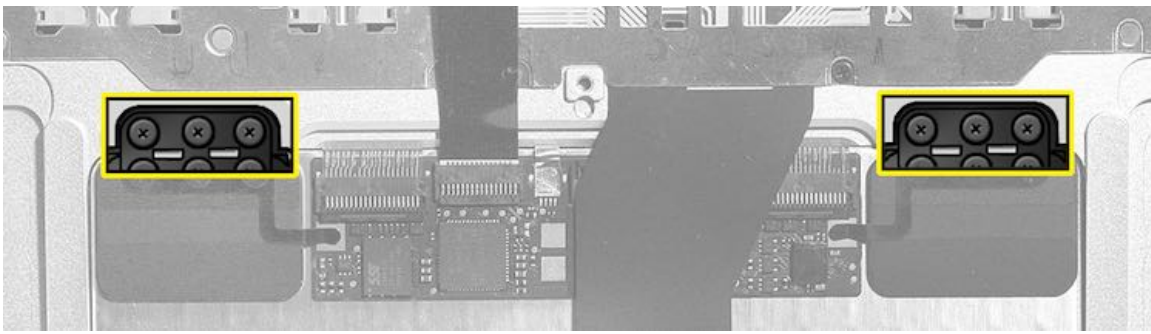
- Be extremely careful not to scratch trackpad against top case during installation, especially along lower front edge, where there is a protrusion on top case for set screw. Scratches on silver trackpad will create black spots when viewed from user side of trackpad.
- Minimize rubbing edges of trackpad against top case while installing. This could cause tiny cracks to form on trackpad.



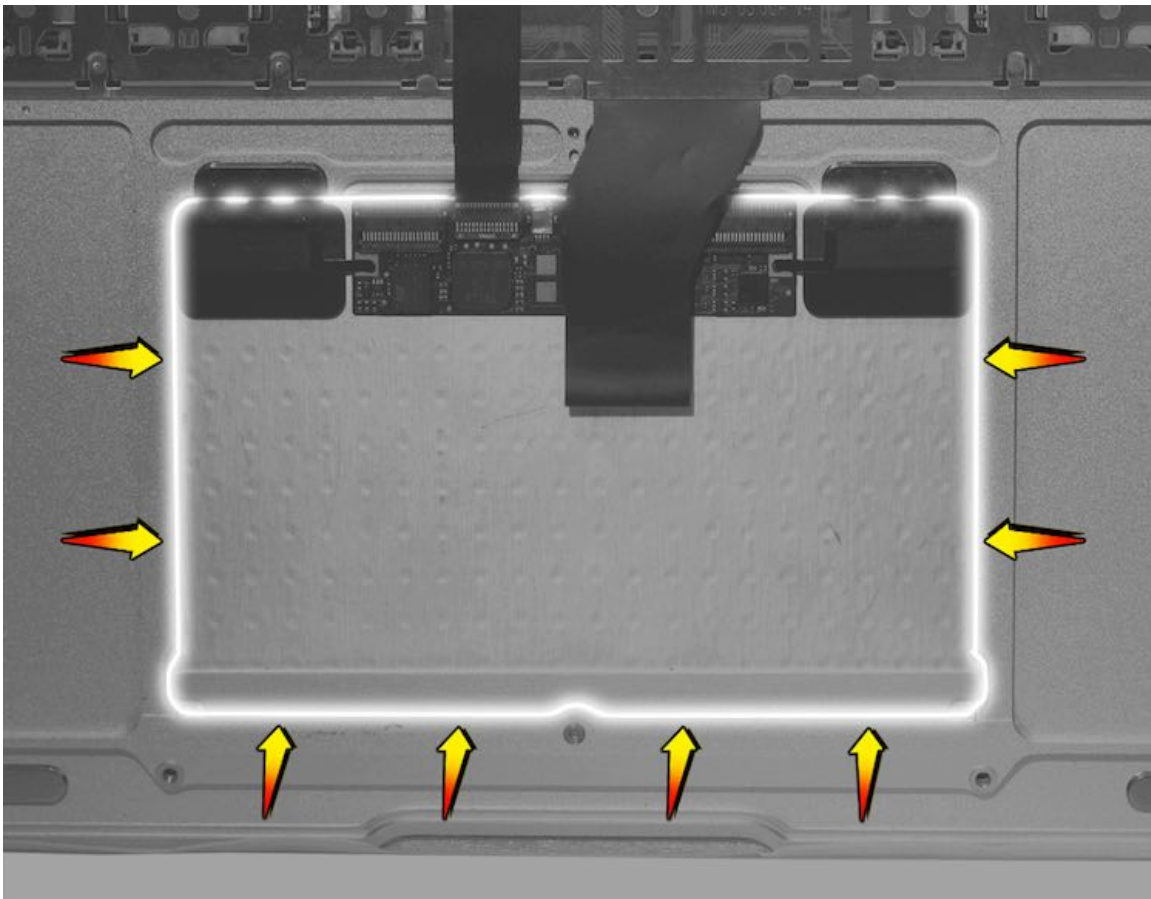
4. Using screws from trackpad kit, loosely insert six **new** Phillips #000 screws, 922-9255 (1.47 mm) in flexures. Do not tighten yet.

Note: Do not reuse old screws.

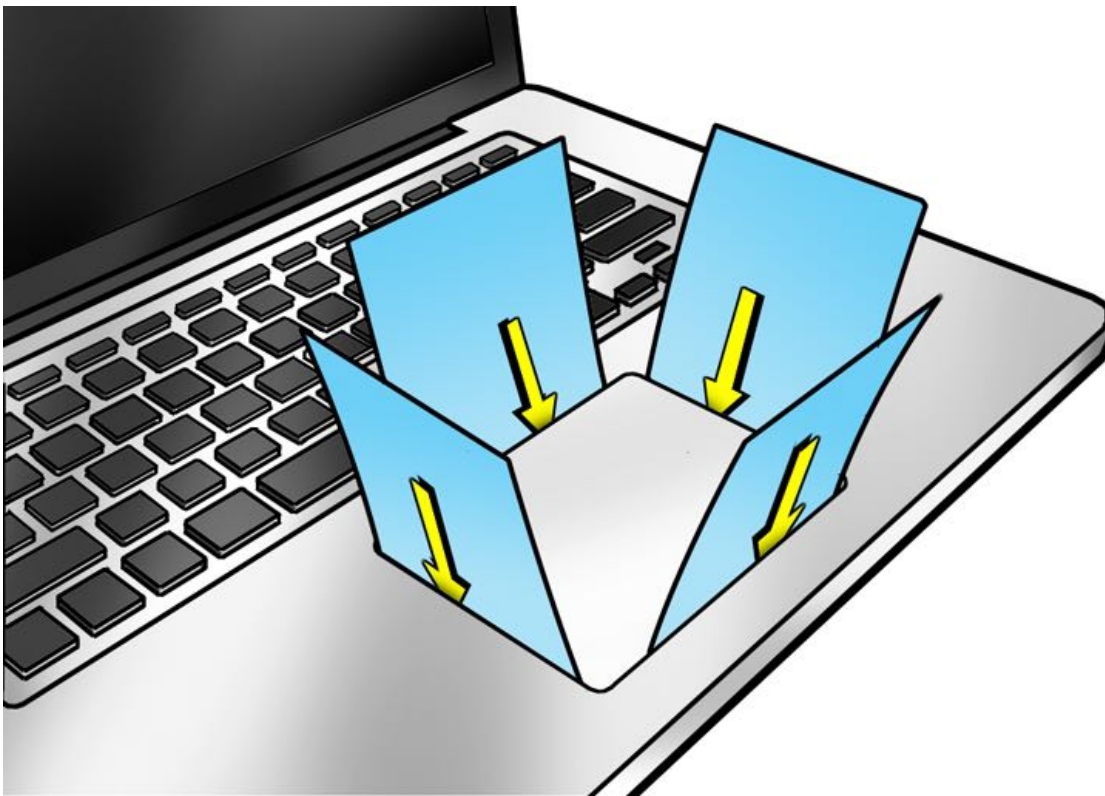




5. Check for even trackpad alignment at top, bottom, and sides by holding top case up to light. Look for even gaps.
6. With even gaps verified, tighten two center screws just enough to provide light tension on trackpad for easy alignment.



7. Prior to securing last four screws, double-check trackpad alignment, if necessary, using sticky (Post-it) notes on palm-rest side of trackpad. Insert one note into gap on top and sides of trackpad and two notes stacked on top of each other into gap on bottom of trackpad.
8. Adjust trackpad so all notes are upright.



9. Tilt up case to secure final four screws.

10. Make sure flexure arms are touching the copper pads.

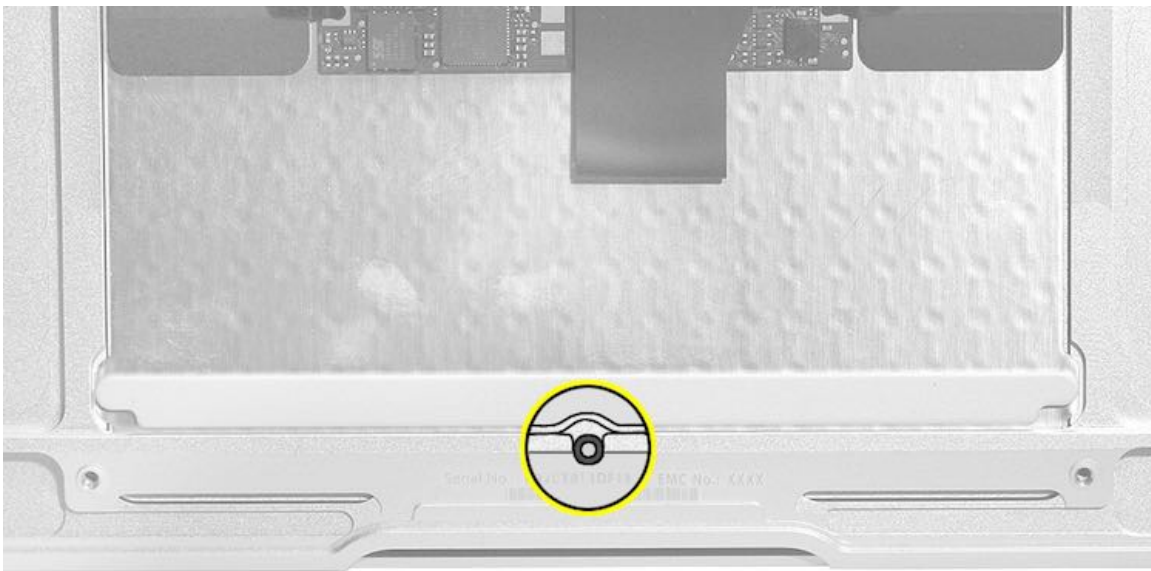
11. Connect IPD flex cable.



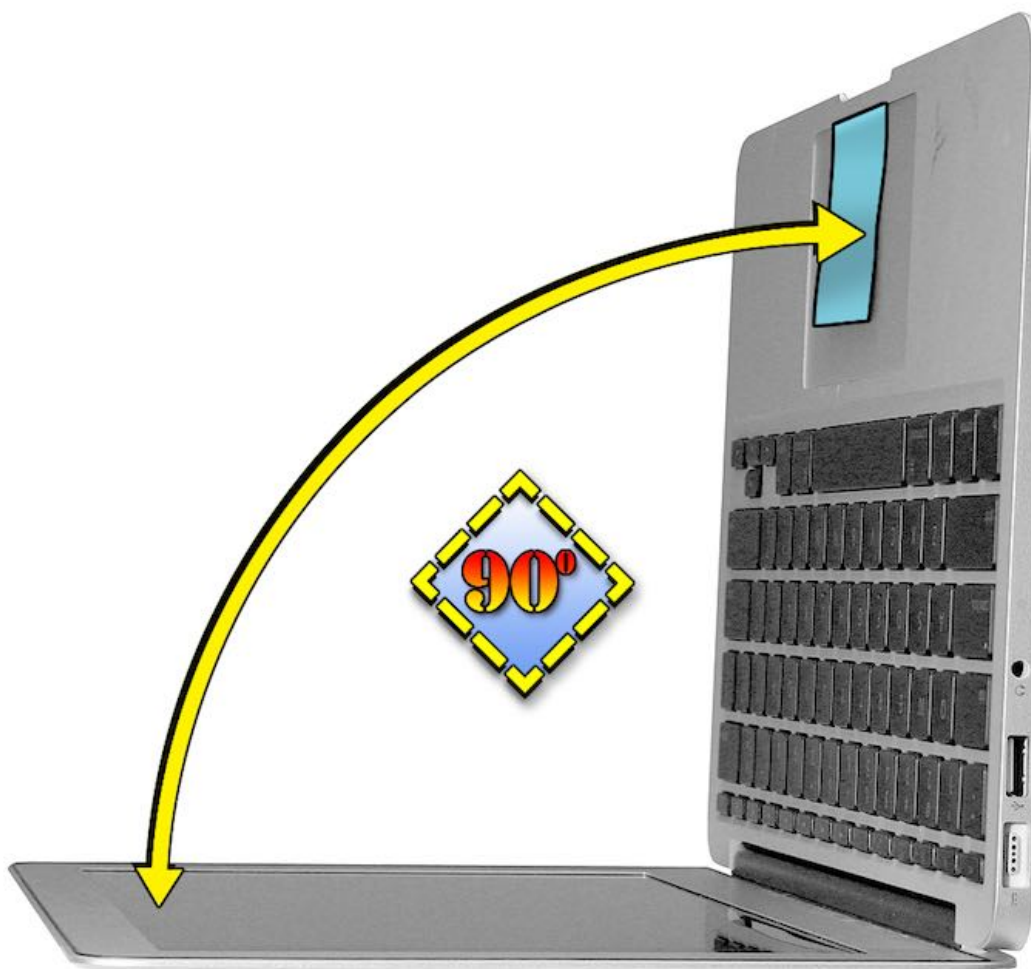
12. If you are installing trackpad in a new top case, loosely adjust T5 set screw, 922-9255 (1.47 mm), and go to next step.



Note: If you are installing trackpad in existing top case, do not adjust set screw, but check trackpad for normal clicking motion and reassemble computer.



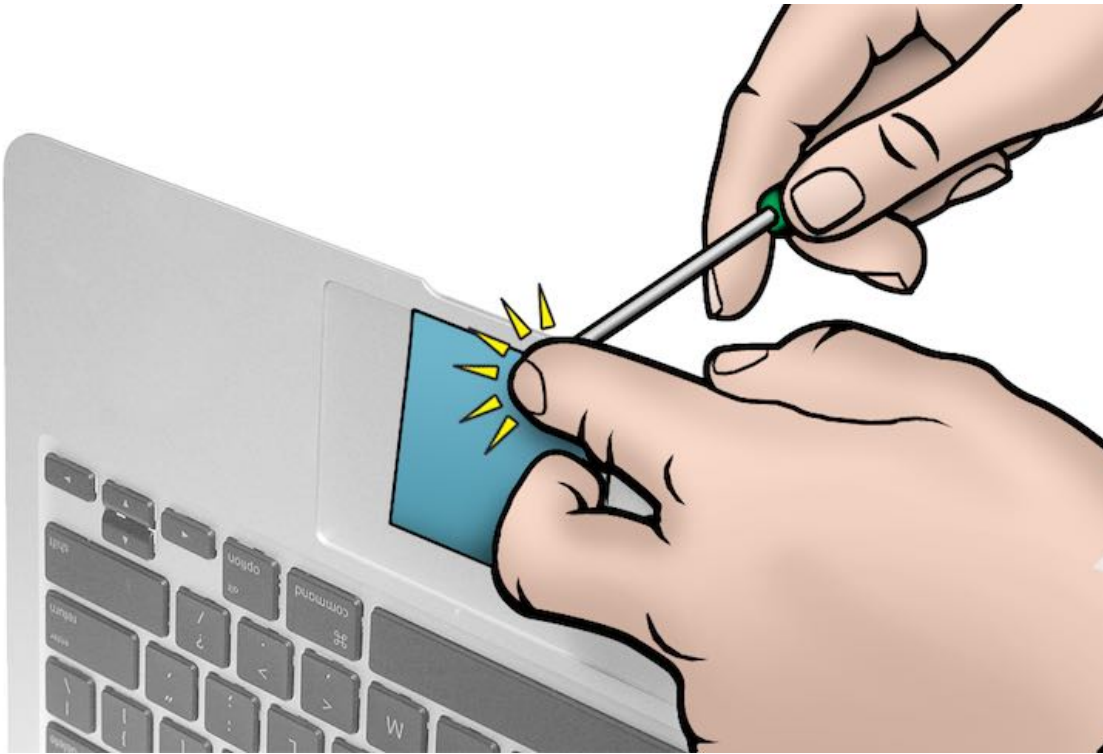
13. Place top case vertically and align one sticky note to bottom edge of trackpad.



14. With one hand on edge of sticky note and other hand slowly adjusting set screw, tighten screw just until sticky note on trackpad feels flush with top case.

Caution: Overtightening set screw can damage trackpad.

15. Remove sticky note and check trackpad for normal clicking motion.



Important: After replacing a Mid 2013, Early 2014, or Early 2015 trackpad, you must use Trackpad Keyboard Mapper to ensure the trackpad is coded to match keyboard version.

- For Mid 2013 and Early 2014 models, refer to article [TP1016: AST Reference Guide: Using the Trackpad Keyboard Mapper](#).
- For the Early 2015 model, use the Trackpad Keyboard Mapper in AST 2. For more information about AST 2, refer to article [TP1105: AST 2 Reference Guide](#).

If the trackpad is replaced and not programmed using the Trackpad Keyboard Mapper tool:

- Only basic or generic keyboard functionality may be available
- The keyboard may not operate correctly
- The keyboard backlight function keys may not control the keyboard backlight brightness

Display Clamshell

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT205332: About AppleCare service certifications](#).

For video instruction, refer to article [SV189: Display Assembly Replacement Video](#).

Remove:

- [Bottom Case](#)
- [Battery](#)
- [I/O Flex Cable](#)
- [SSD Card or Flash Storage](#)
- [Fan](#) (Late 2010, Mid 2011, and Mid 2012)
- [Fan](#) (Mid 2013, Early 2014, and Early 2015)
- [I/O Board](#) (Late 2010, Mid 2011, and Early 2014 only)
- [Logic Board](#) (with heat sink attached)



Important: Immediately after removing the bottom case, always attach the battery cover and disconnect the battery cable from the logic board.

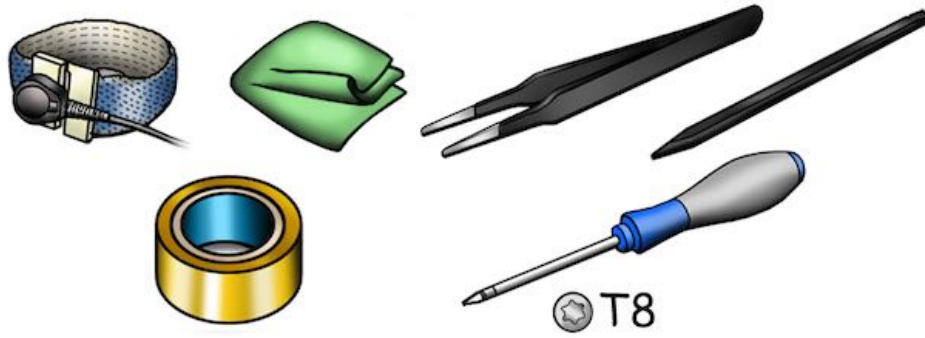
Caution: Read [Battery Safety Precautions](#) before beginning this procedure.



Tools

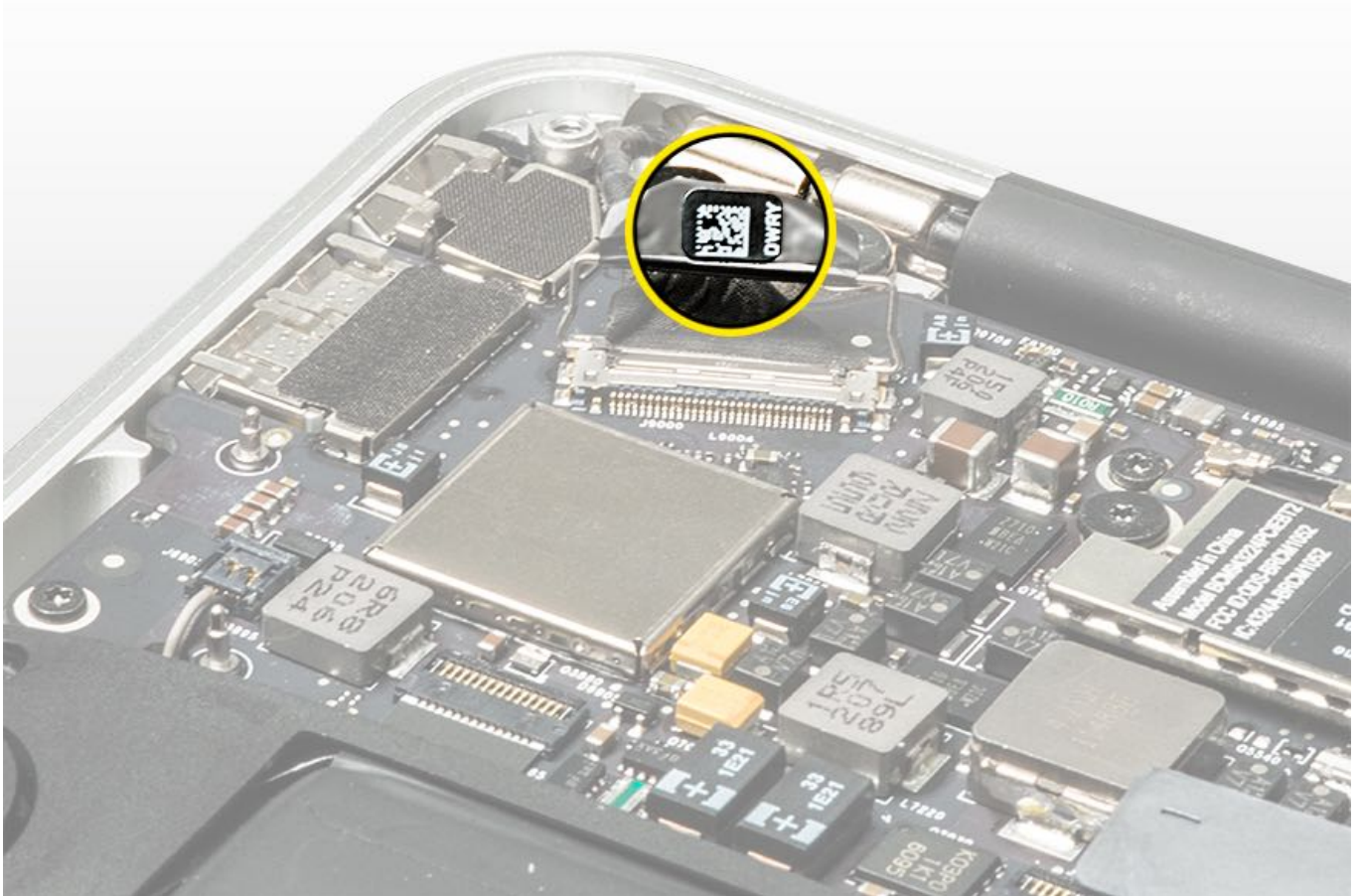
- ESD wrist strap
- Clean, soft, lint-free cloth
- Tweezers
- Black stick
- Kapton tape

- Torx T8 screwdriver (magnetized)

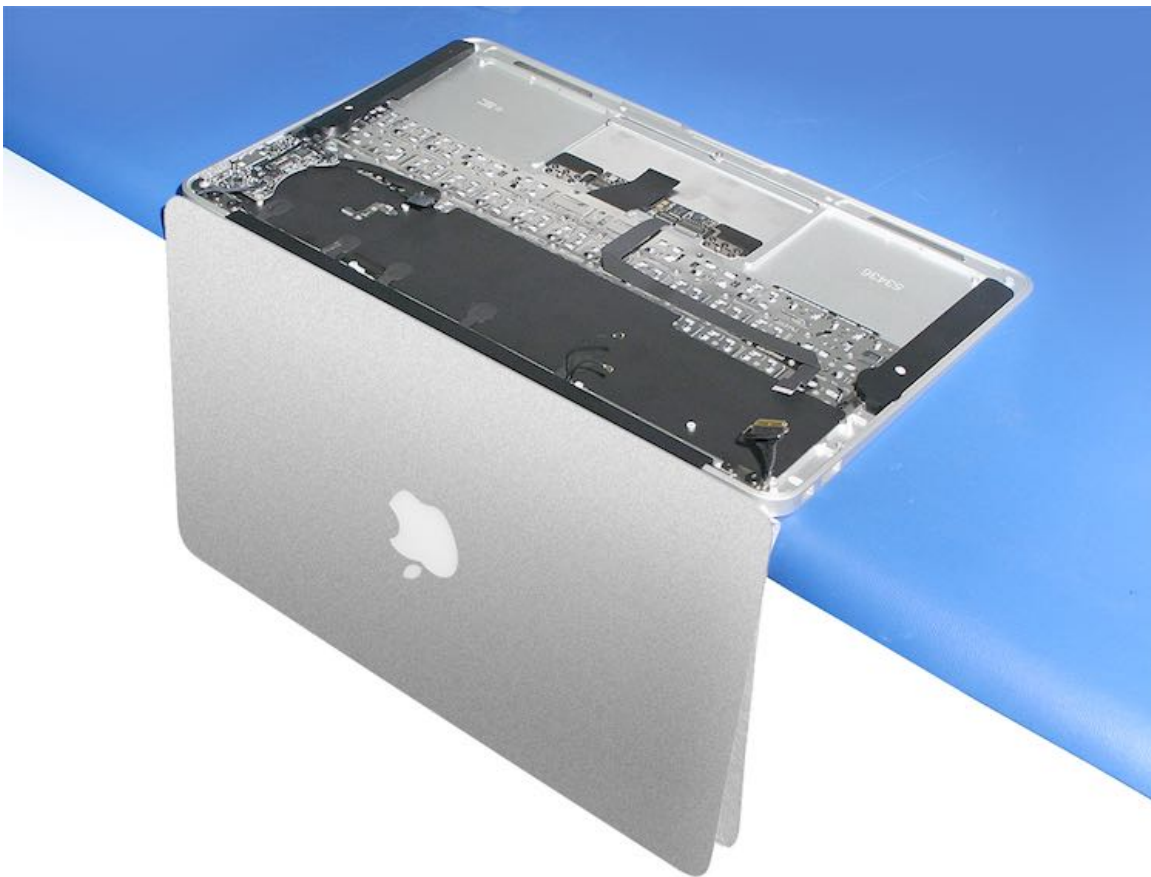


Steps For Removal

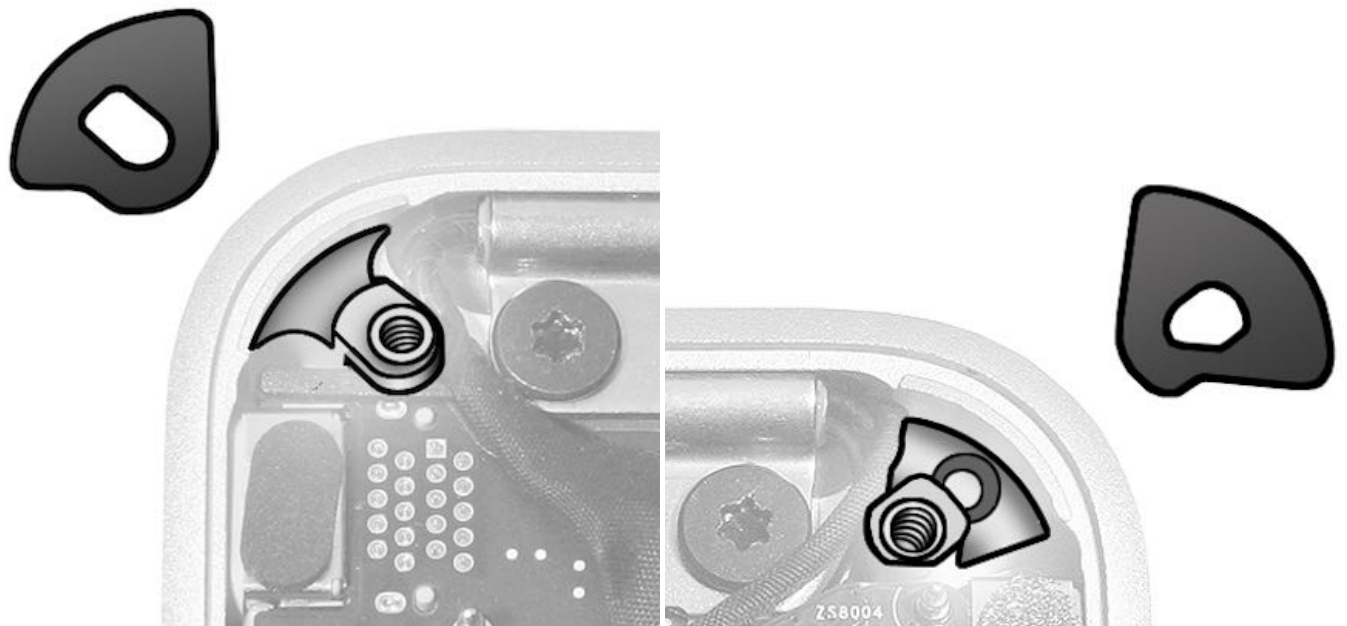
Note: The Mid 2012, Mid 2013, Early 2014, and Early 2015 models include a 2D bar code of the display clamshell serial number located on the underside of the pull tab for the eDP cable. The bar code links the display to the system serial number.



1. Place display (open to 90 degrees) so it safely hangs over a clean, padded table edge. Back of display clamshell should face you. Use a clean, soft, lint-free cloth to protect computer from scratches.



2. Retain two wedge-shaped rubber cable gaskets from rear corners of top case. Gaskets are unique to each rear corner.



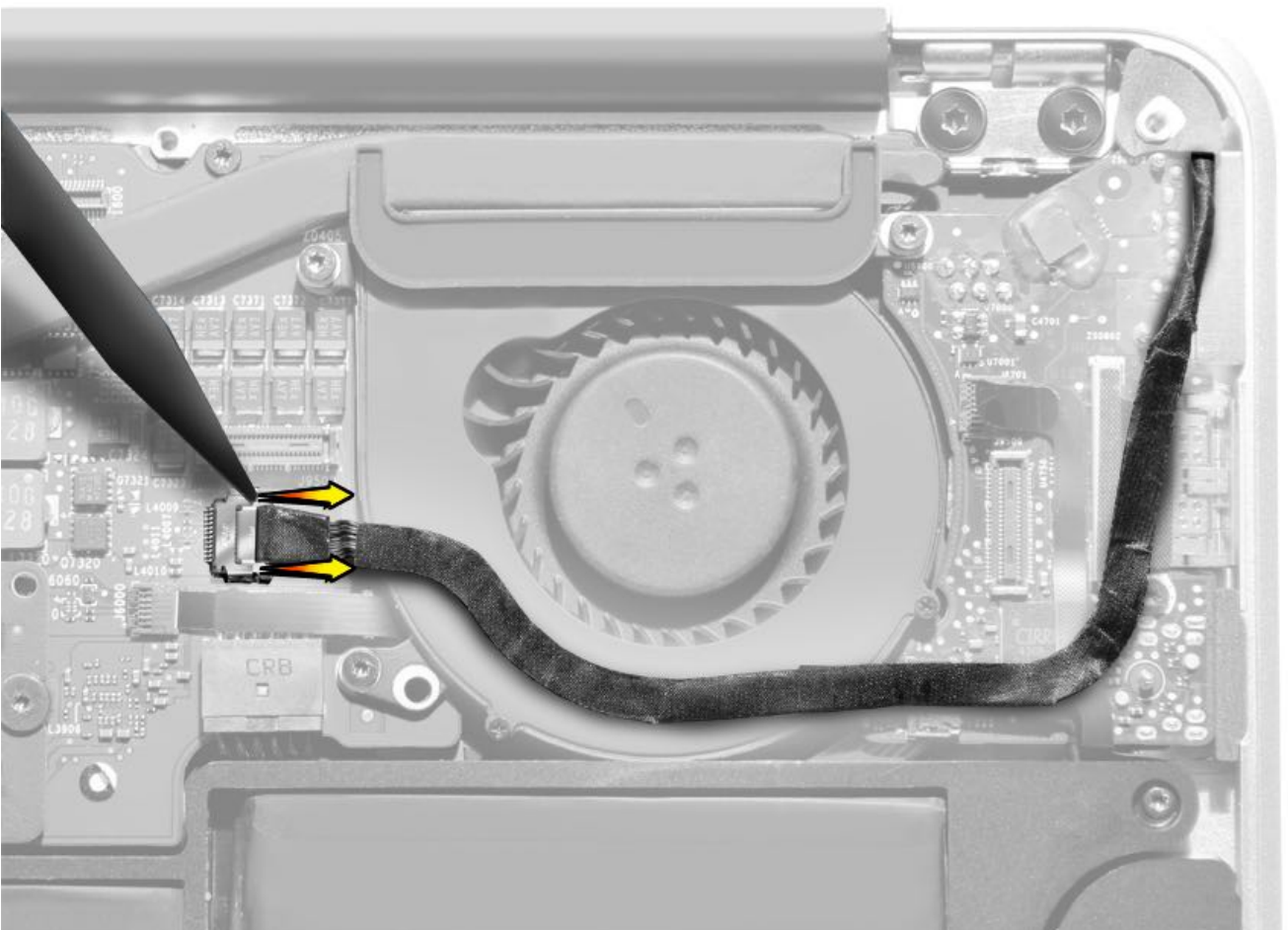
3. Disconnect camera cable from I/O board.

Late 2010, Mid 2011, and Mid 2012

Note: Mid 2012 camera cable is in a slightly different position.



Mid 2013, Early 2014, and Early 2015



4. Peel up wireless cable labels.

Caution: Do not use excessive force when peeling wireless cable labels to avoid damaging or removing the labels.

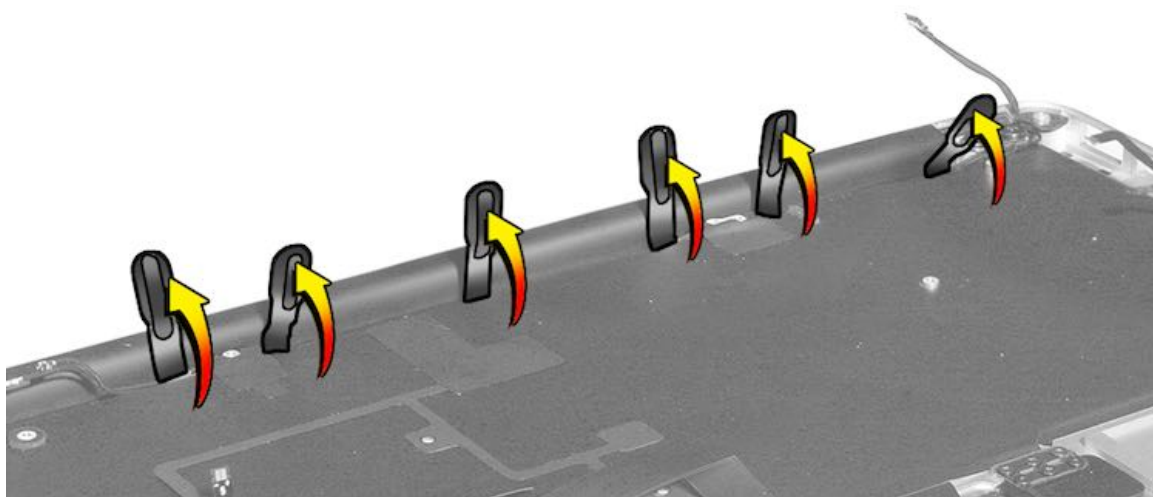
Note: You might notice a slightly different label shape. The number of cable labels differs per model:

- Five for Late 2010
- Six for Mid 2011 and Mid 2012
- Seven for Mid 2013, Early 2014, and Early 2015

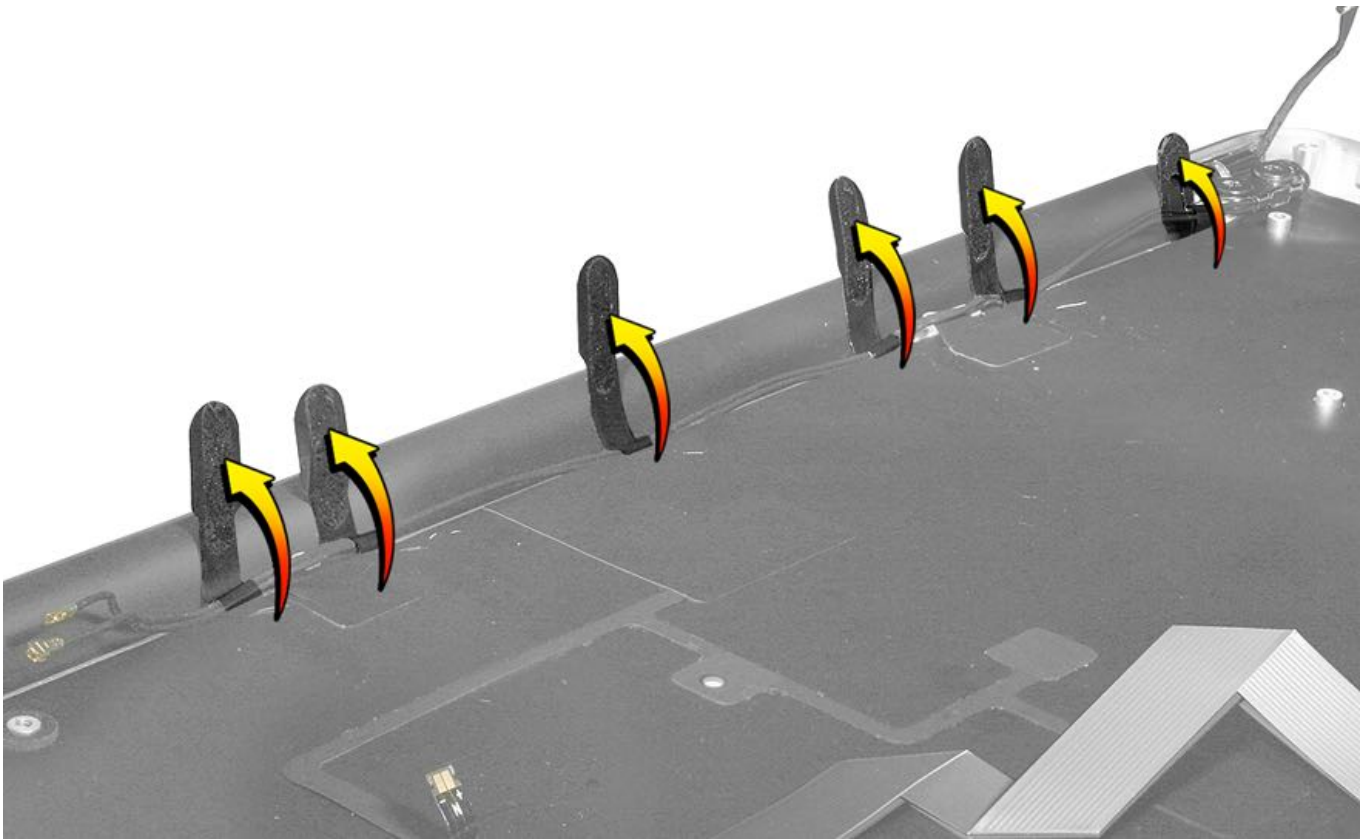
Late 2010



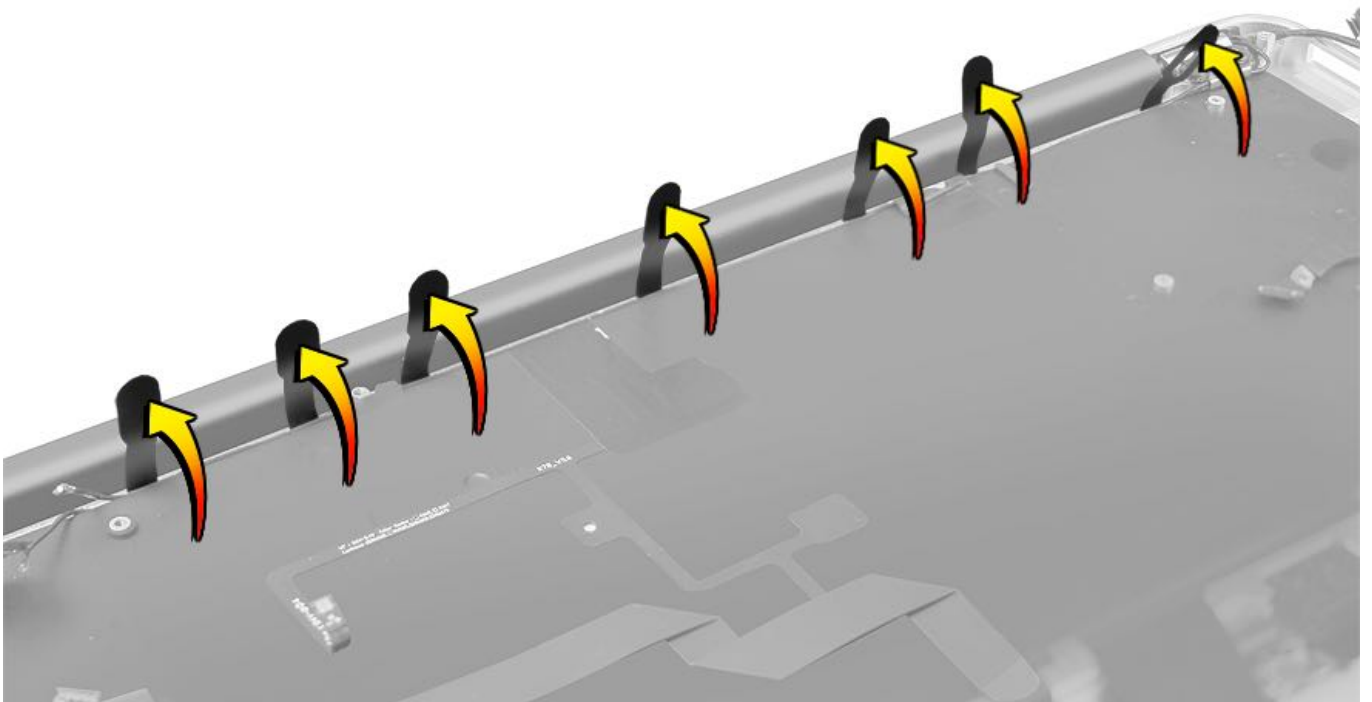
Mid 2011



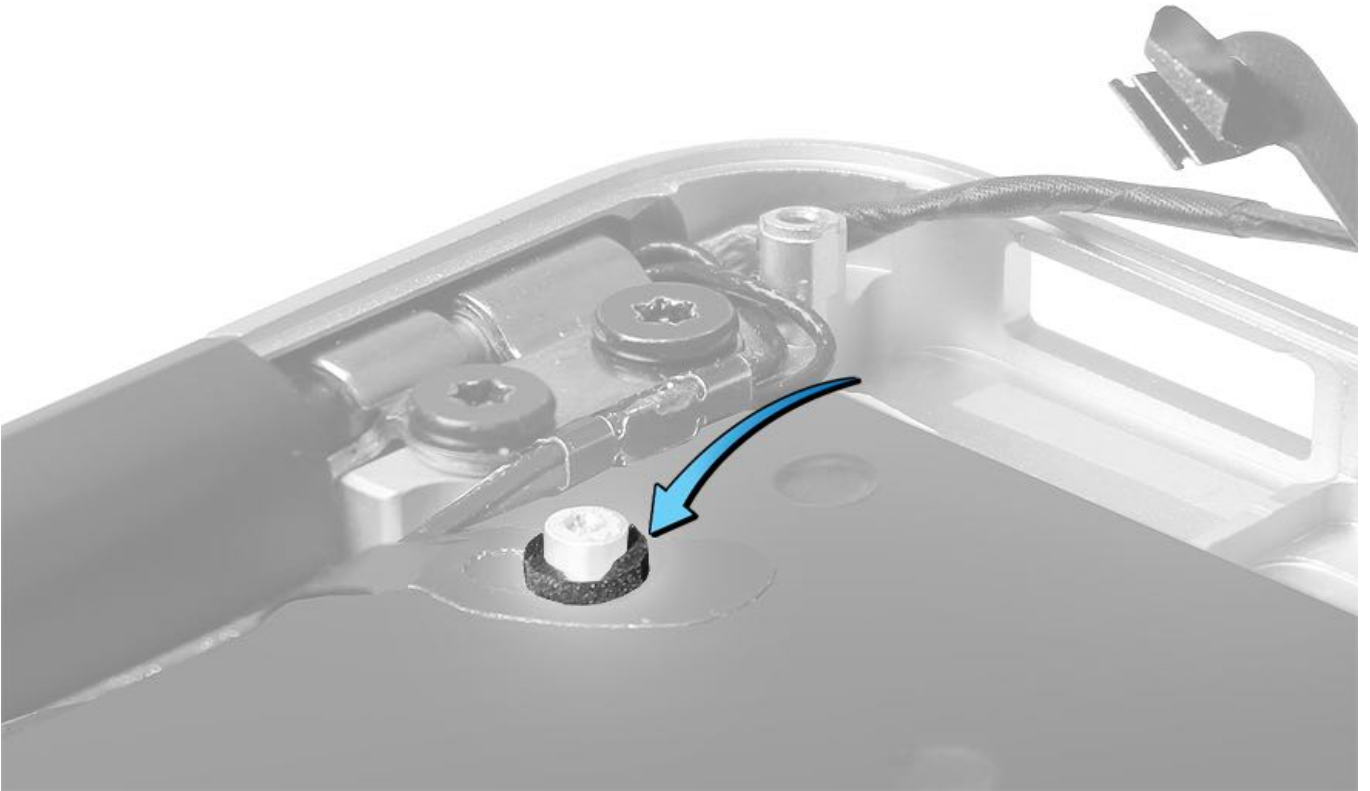
Mid 2012



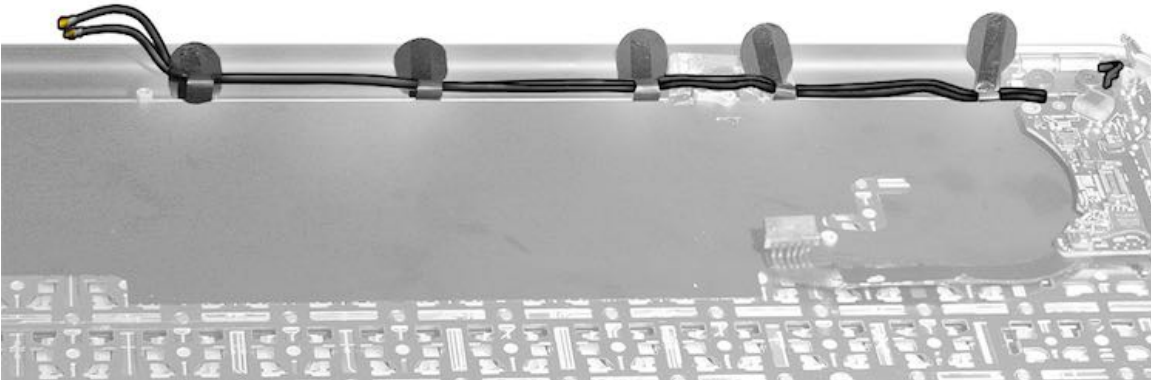
Mid 2013, Early 2014, and Early 2015



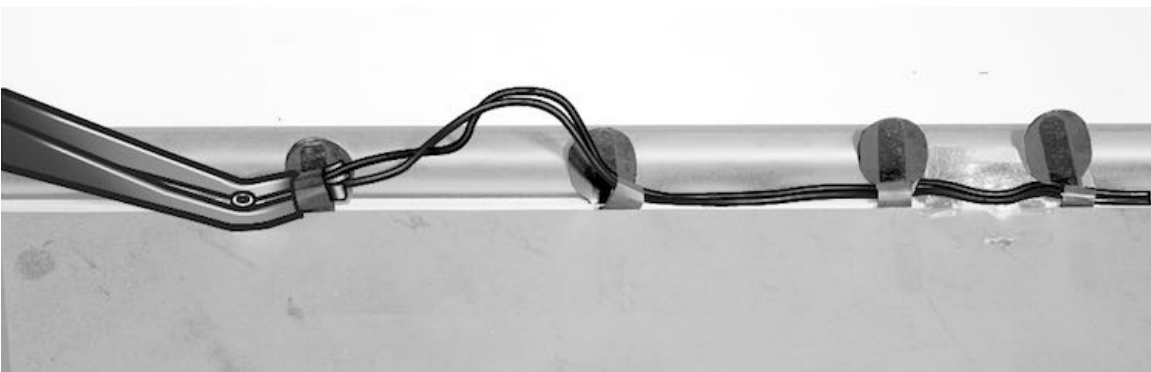
5. Mid 2013, Early 2014, and Early 2015 only: Note the foam spacer at seventh cable label.



6. Use a black stick to pull looped end of labels through slots.

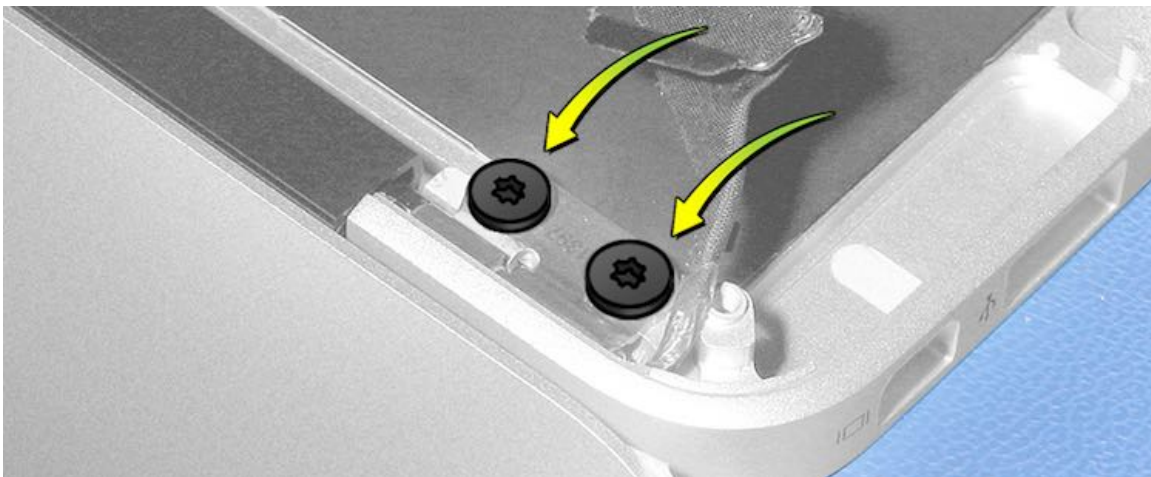
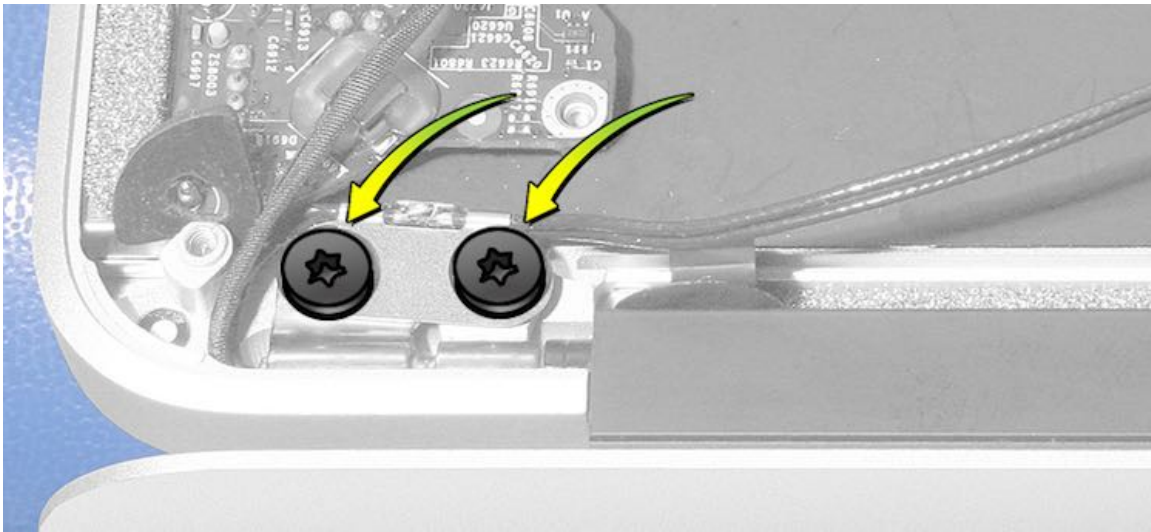


7. Use tweezers or black stick to hold open each loop as you feed the pair of antenna cables toward I/O board.



8. Remove four Torx T8 screws, two at each clutch:

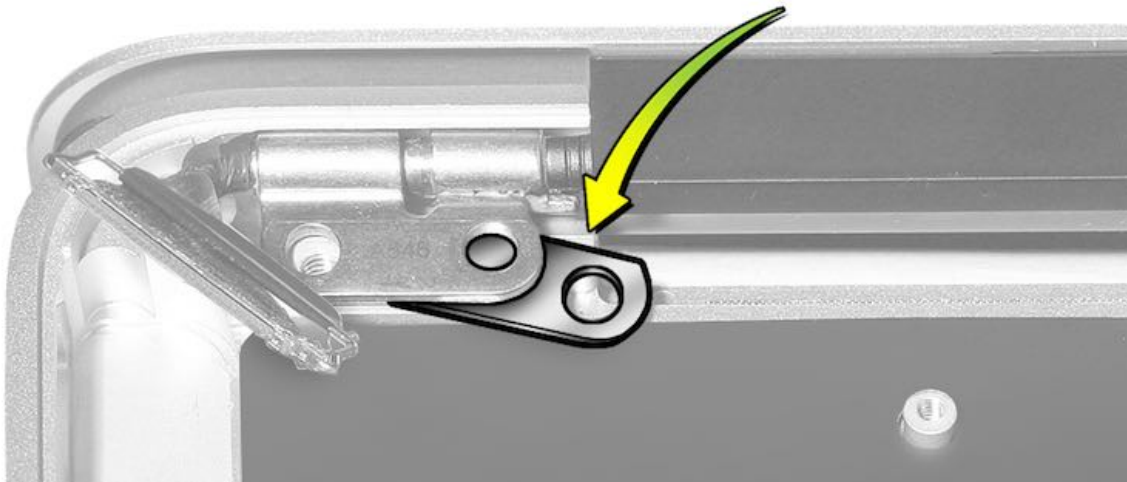
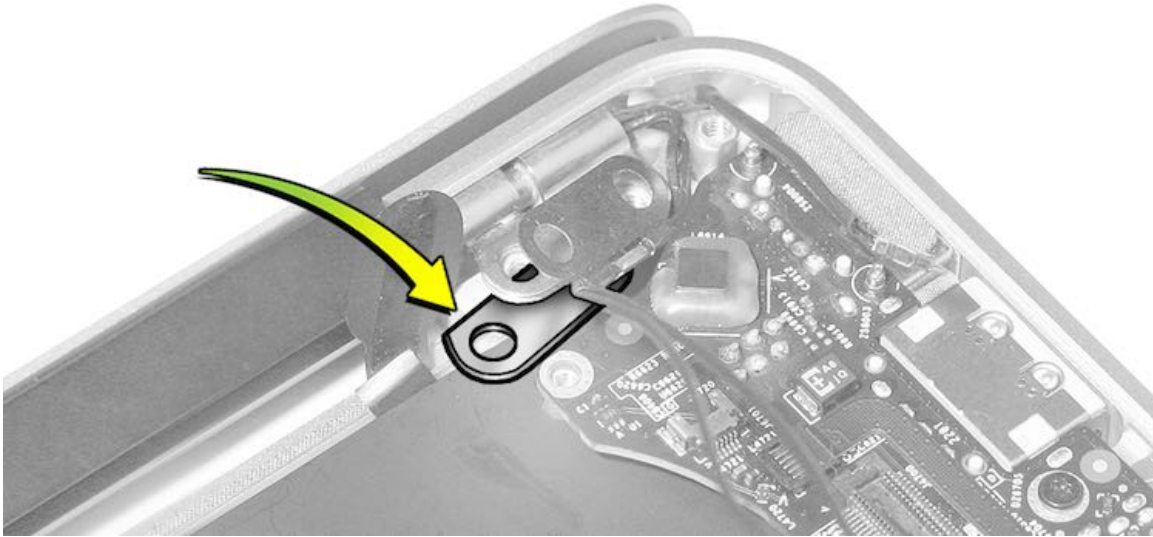
- 922-9688 (4.85 mm)



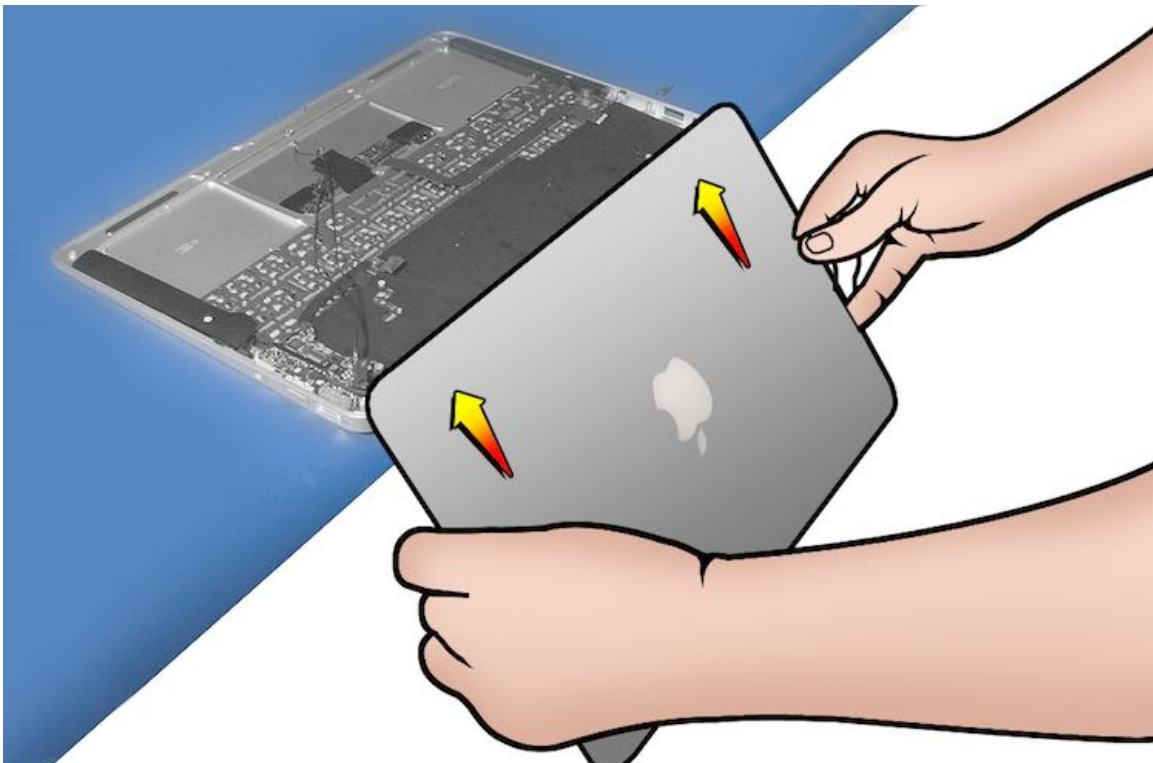
9. **Late 2010 only:** Reserve metal shim at each clutch: 922-9695 (0.2 mm thick)



Replacement Note: Place one shim under each clutch hinge before securing clutch screws. At hinge with antenna cables, clutch hinge fits in between shim and cable retainer.



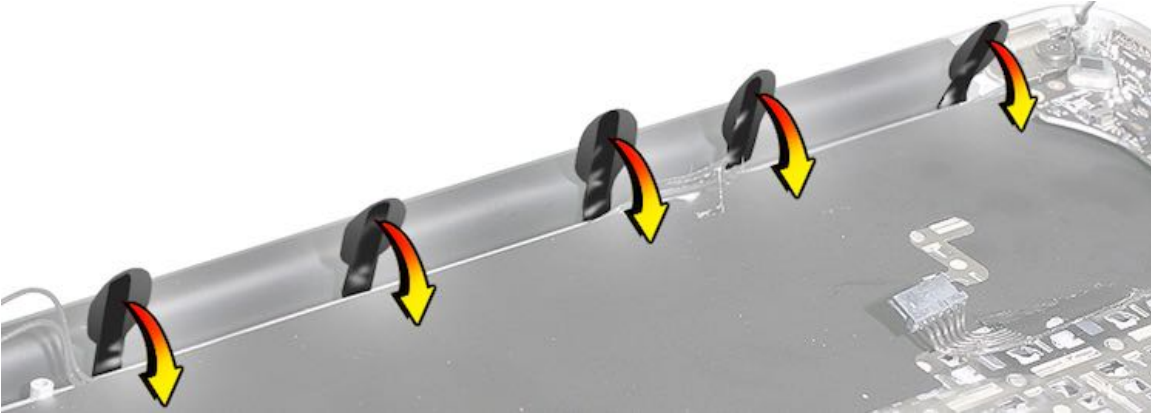
10. While supporting computer, separate display clamshell from top case.



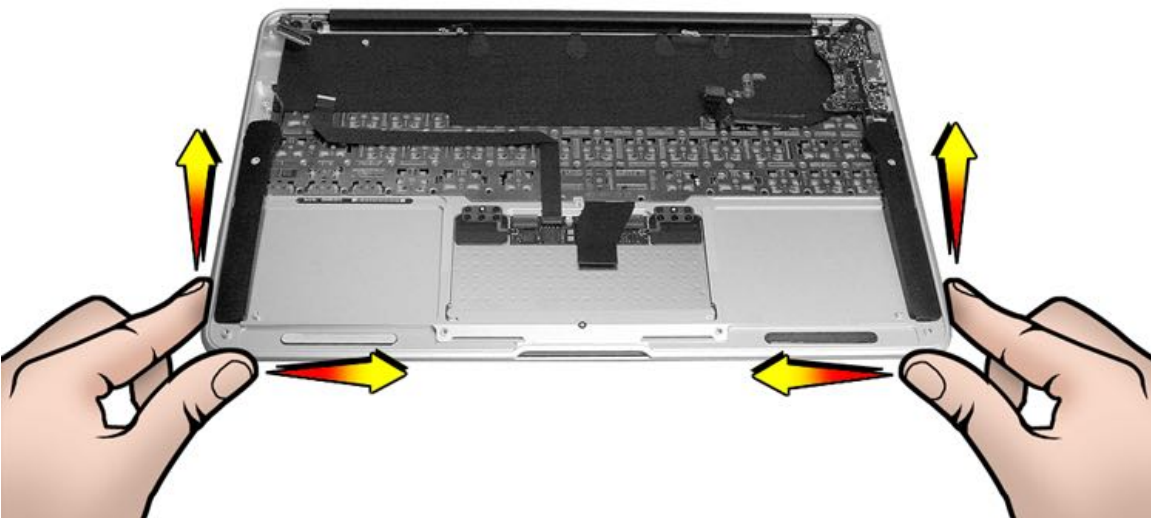
Steps For Reassembly

Note: If you are replacing the display clamshell, as opposed to the top case, reuse the wireless cable labels unless they are damaged. If labels are damaged, install new ones as shown in [Wireless Cable Labels](#).

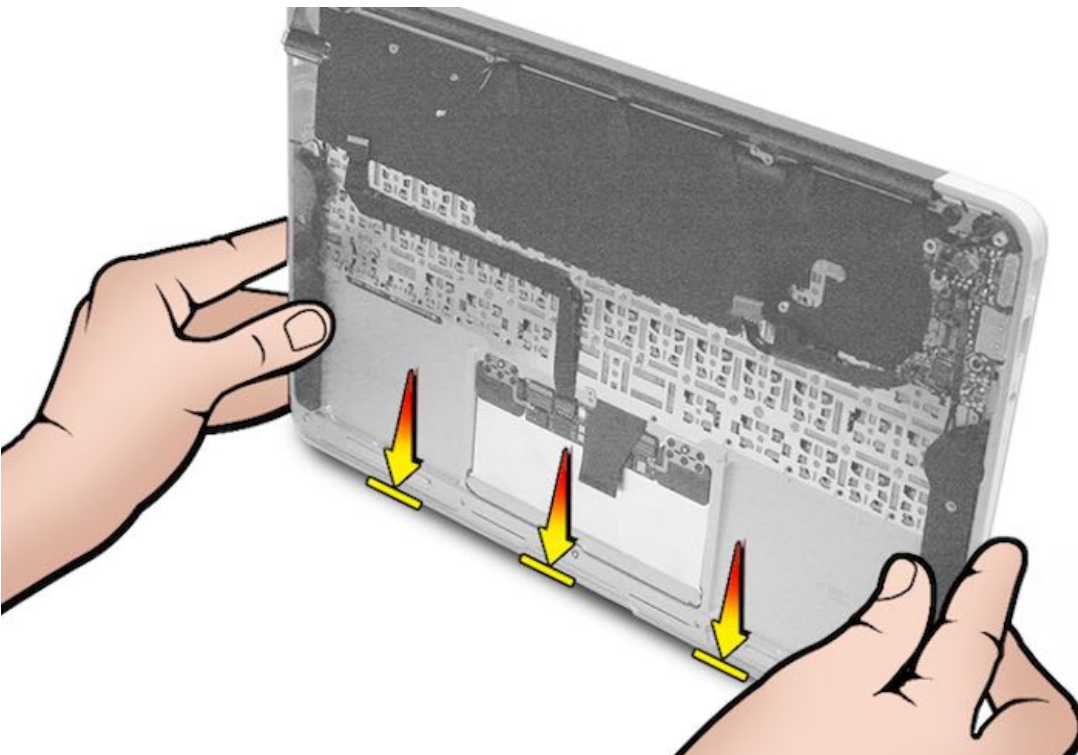
1. With shims (Late 2010 only) under clutch hinges, loosely install screws.
2. Close display and place computer on a flat surface.



3. Adjust alignment by touch.



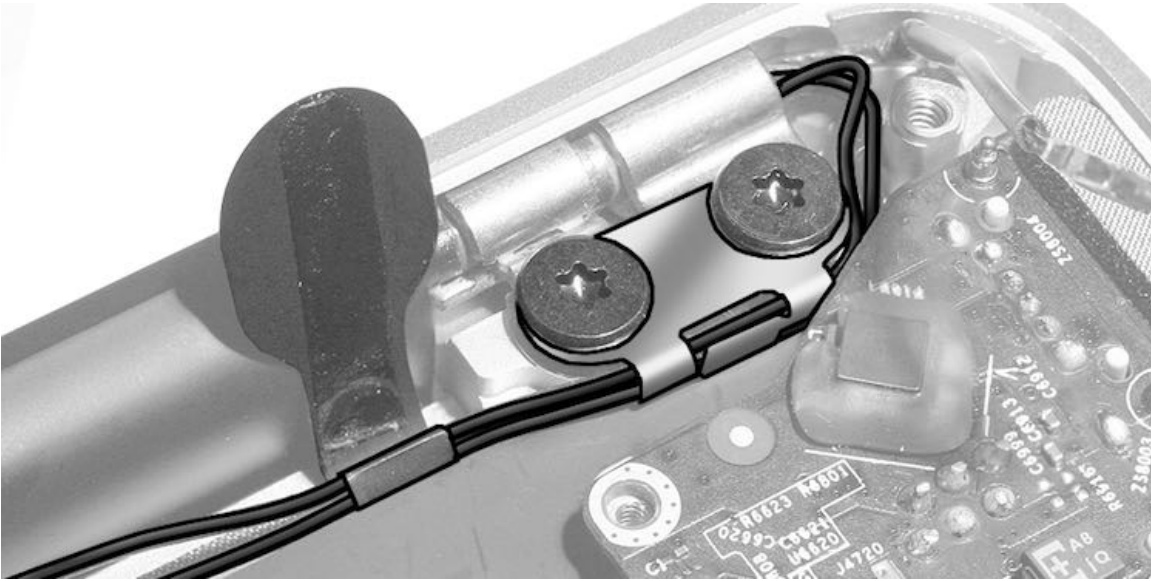
4. Stand up computer on a clean, flat surface to level front-to-rear clutch alignment.



5. Secure screws hand tight, and pull cable labels up from display clutch.

6. Note cable routing at display hinge for reinstalling antenna cables.

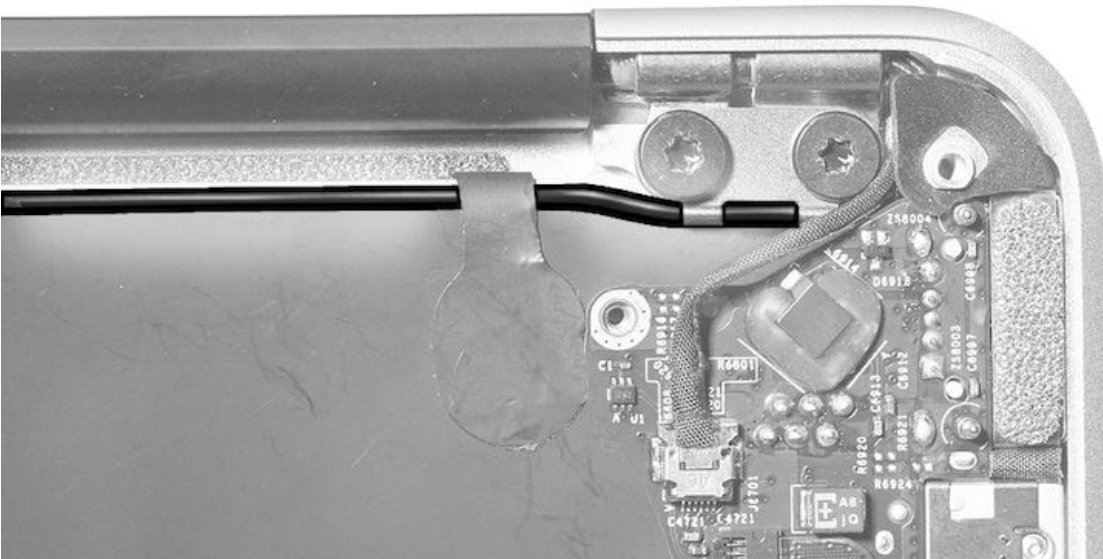
7. Feed paired cables through loop of each wireless cable label and into slot.



8. Route cables into slot, one on top of the other. Make sure they maintain that orientation (already set by the retainer) throughout.

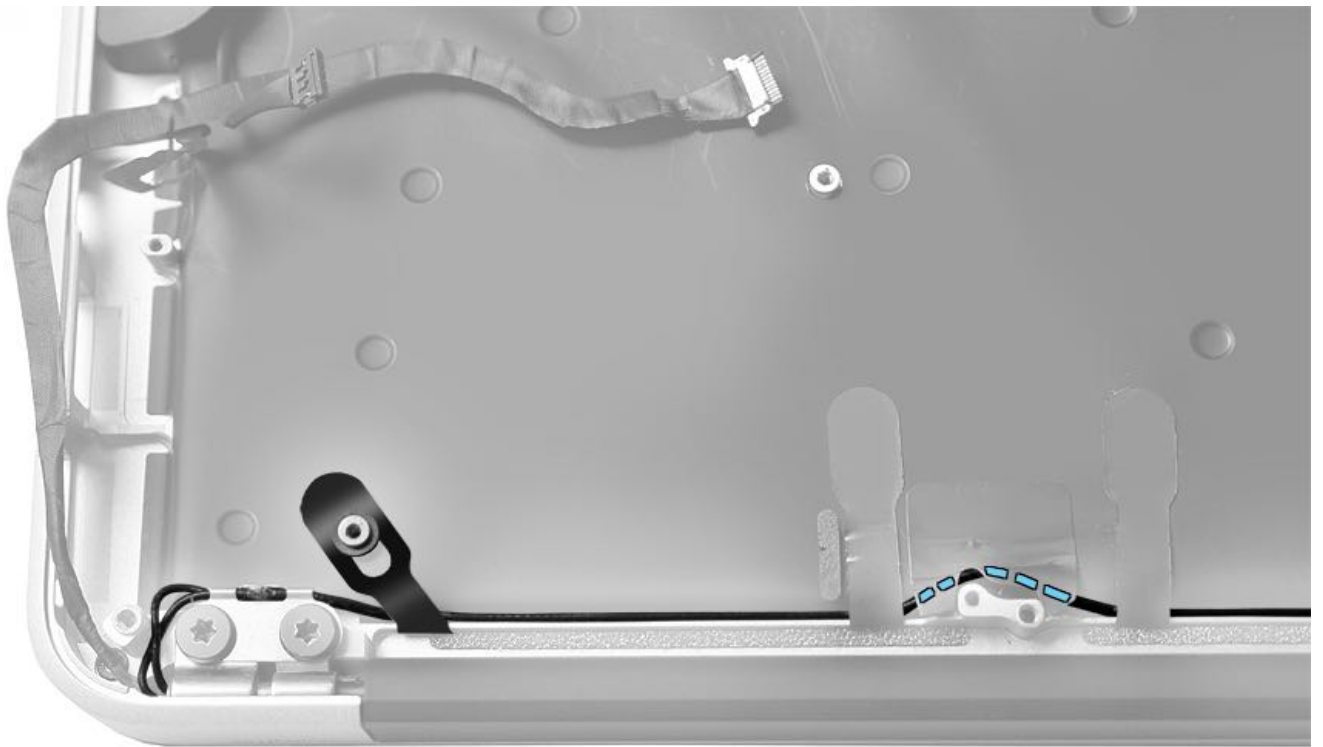
Avoid:

- Twisted cables
- Pinched cables
- Excess cables

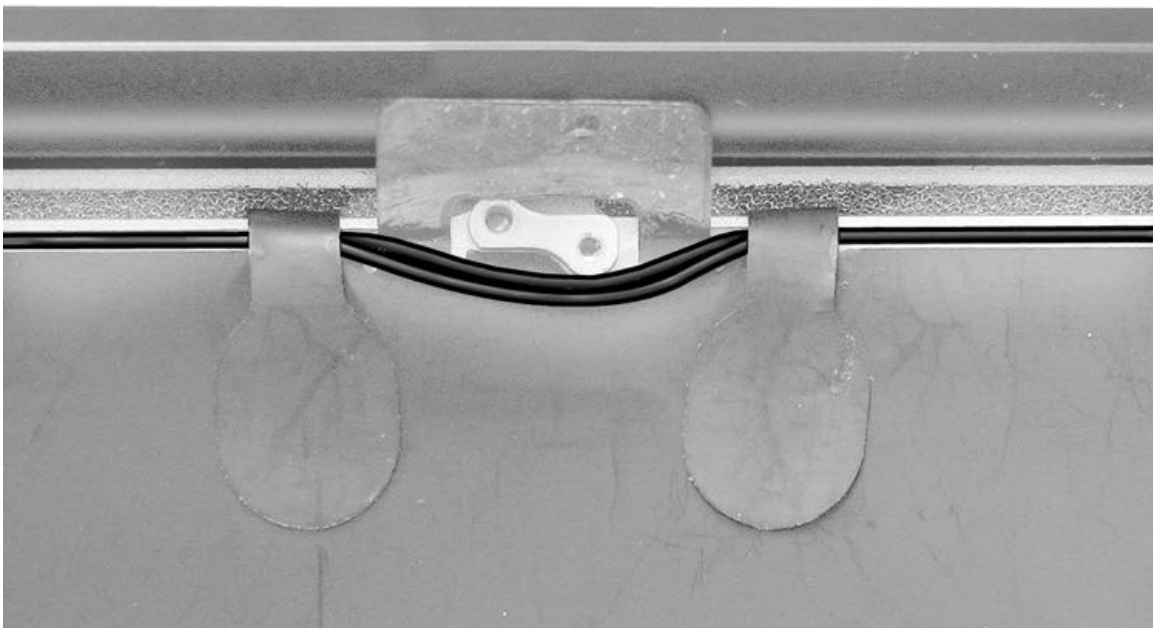


Mid 2013, Early 2014, and Early 2015 only: Ensure cable label fits over top case standoff and foam spacer is installed.

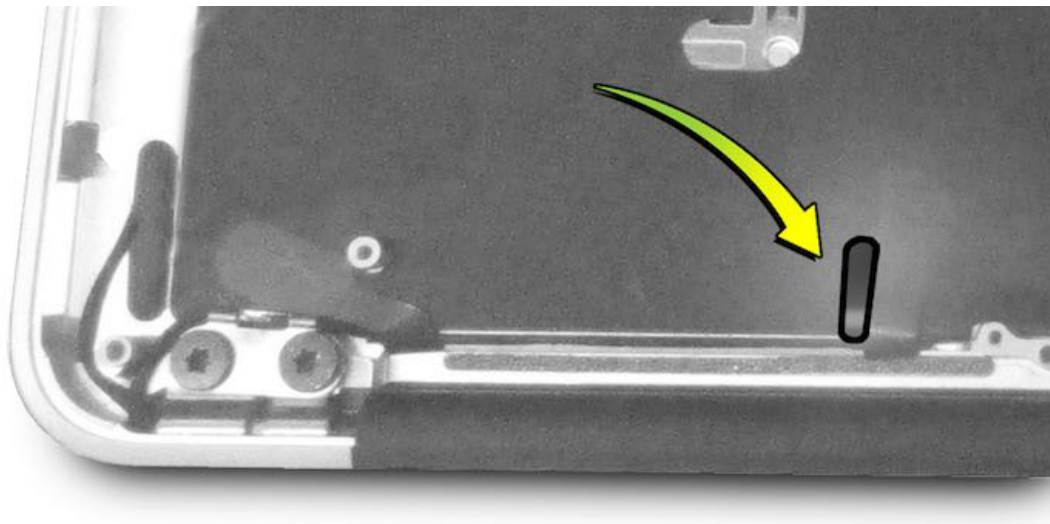
Note: Some Late 2010 production models might also include a cable label with an opening for the top case standoff.



9. Continue routing antenna cables to the left, tucking them into slot.

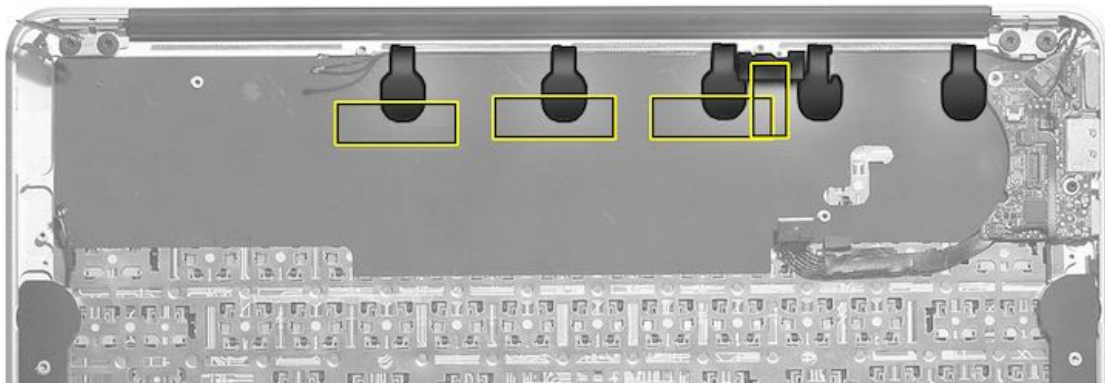


10. If foam pad under fan is moved during this procedure, reposition it beside second cable label, as shown.

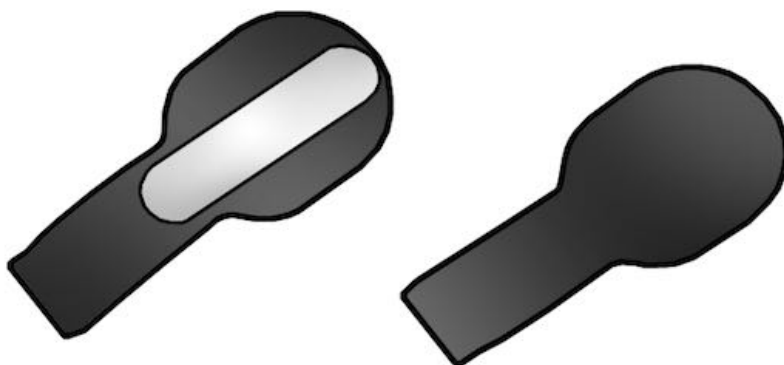


11. **Note:** If adhesive on a cable label no longer sticks, replace cable label. If a replacement is not available, apply one strip of Kapton tape over the lower two-thirds of any of the cable labels shown.

The fan body maintains pressure on the other two cable labels.



Caution: Do not add tape under fan; doing so could result in fan noise or impede fan function. Instead, make sure labels under fan are completely flush with top case. If not, replace labels under fan.



Wireless Cable Labels

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT202594: Exams for Service Technicians](#).

For video instruction, refer to article [SV190: Wireless Cable Labels Replacement Video](#) (Mid 2012 and Mid 2013).

Remove:

- [Bottom Case](#)
- [Battery](#)
- [I/O Flex Cable](#)
- [SSD Card or Flash Storage](#)
- [Fan](#) (Late 2010, Mid 2011, Mid 2012)
- [Fan](#) (Mid 2013, Early 2014, and Early 2015)
- [I/O Board](#) (Late 2010 and Mid 2011 only)
- [Logic Board](#) (with Heat Sink and AirPort/Bluetooth Card attached)
- [Display Clamshell](#)

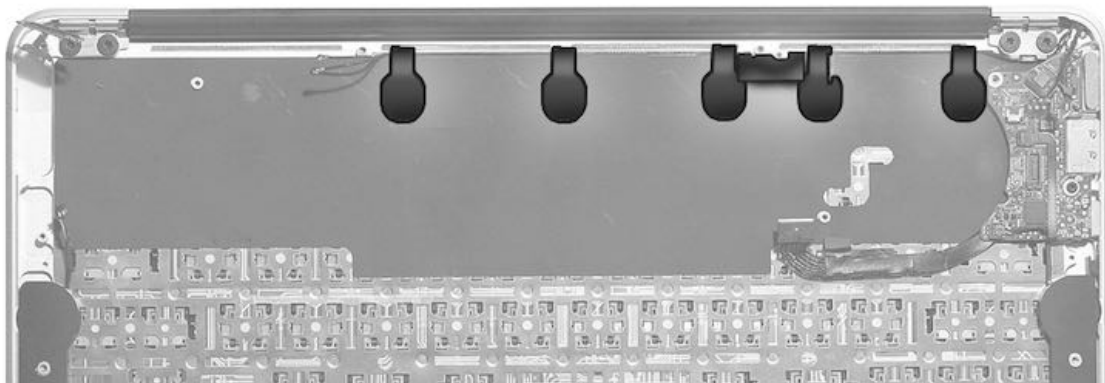


Important: Immediately after removing the bottom case, always attach the battery cover and disconnect the battery cable from the logic board.

Caution: Read [Battery Safety Precautions](#) before beginning this procedure.

Note: If a Late 2010 model has a wireless cable label that is attached to the standoff under the I/O board, you must remove the I/O board to replace that label.

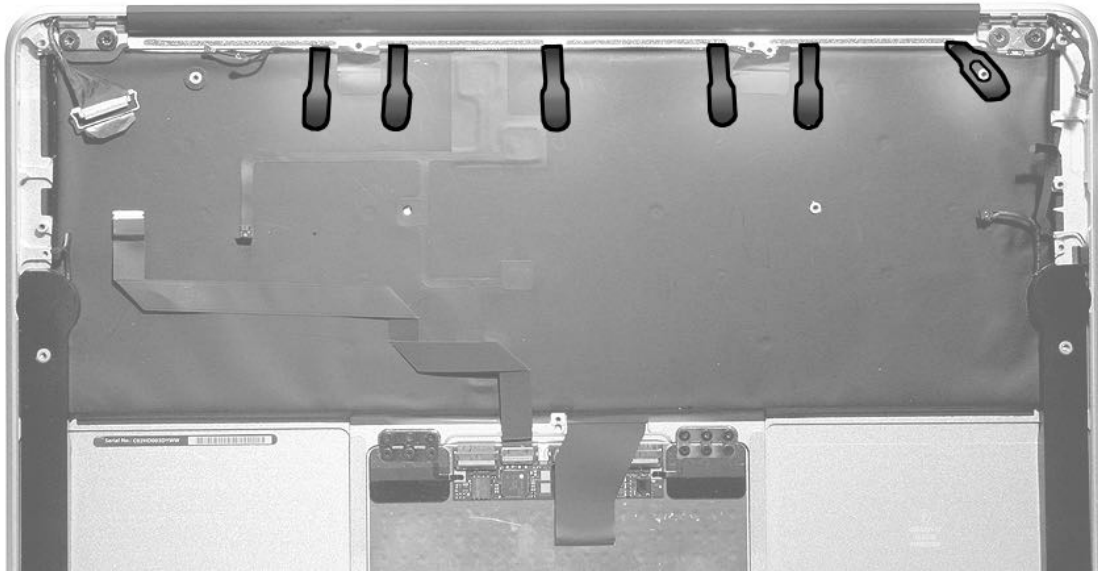
Late 2010



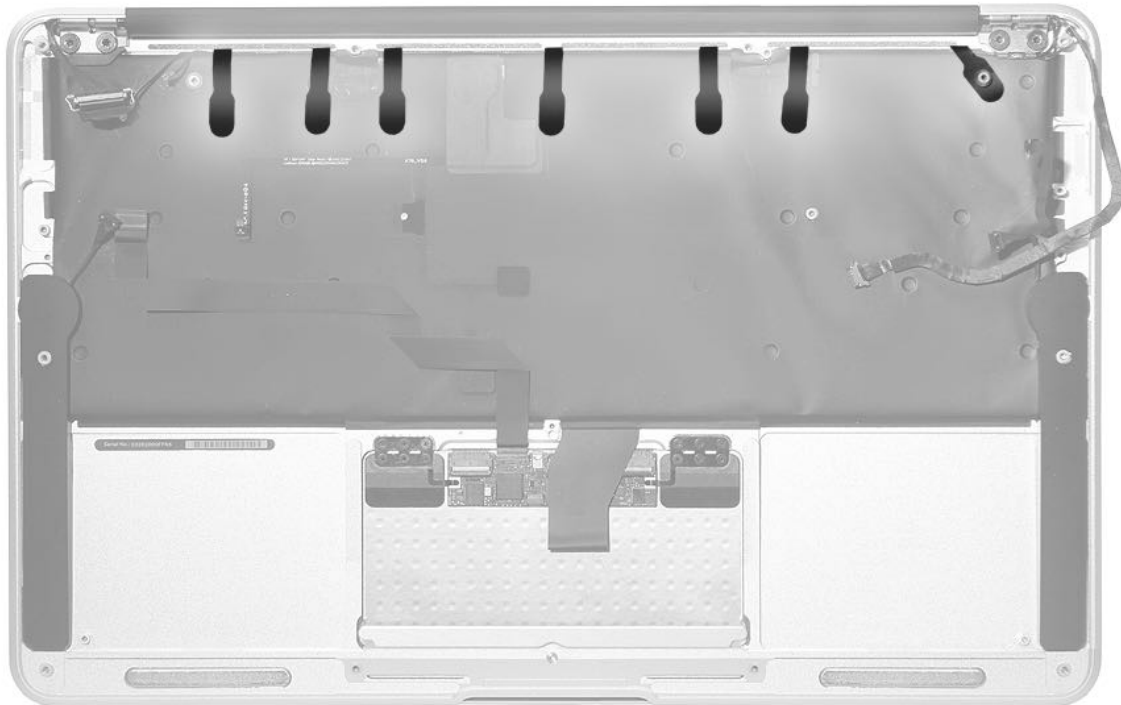
Mid 2011



Mid 2012



Mid 2013, Early 2014, and Early 2015



Tools

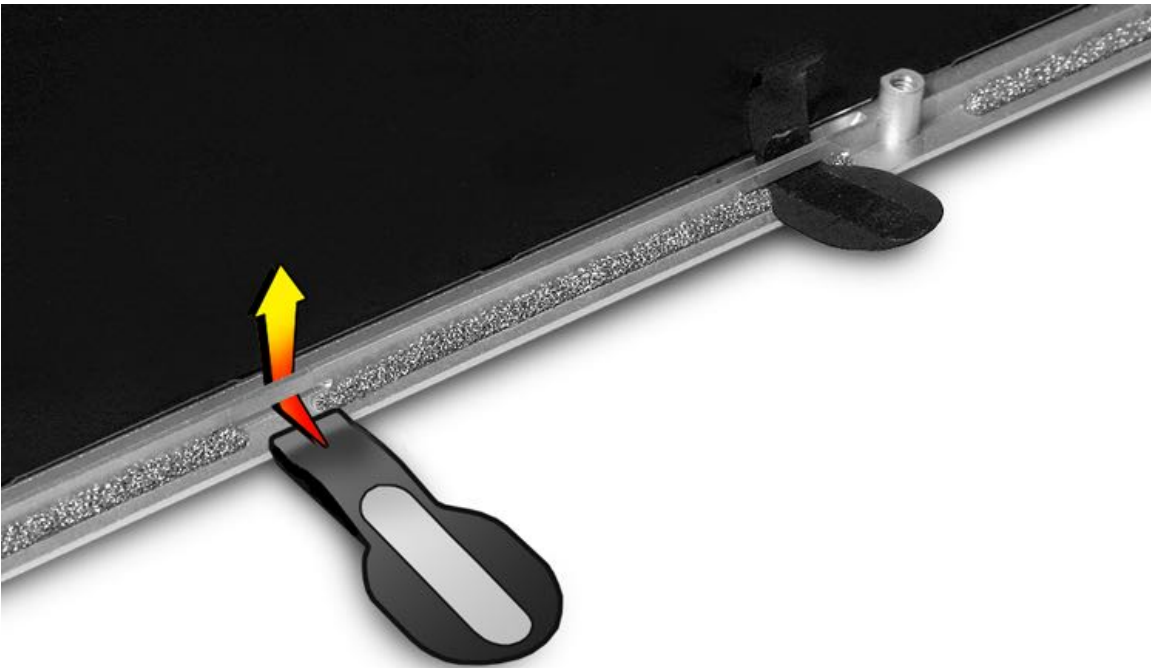
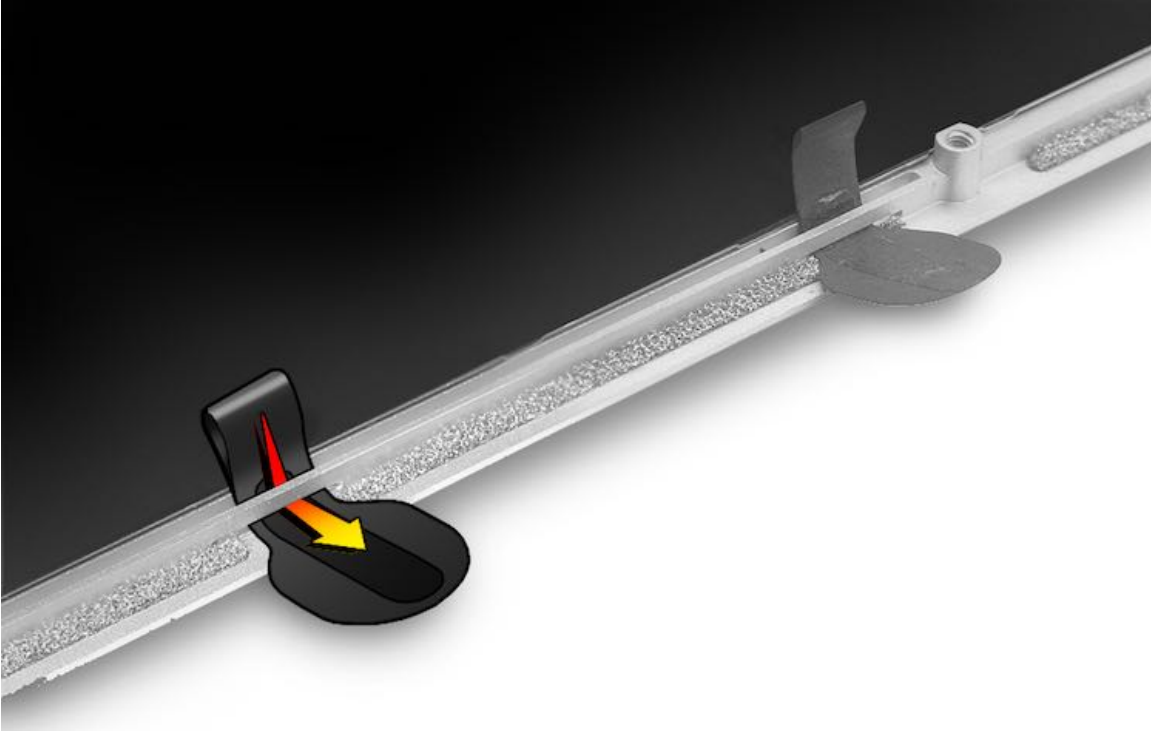
- ESD wrist strap
- Black stick



Steps For Removal

Note: You might notice a slightly different label shape. Pull out wireless cable label(s) from top case. **Only replace those labels that cannot be reused.**

1. Feed narrow end of wireless cable label through slot in top case. Repeat for other labels if necessary.
2. Before removing adhesive strips from labels, align display clamshell to top case as described in [Display Clamshell](#) take-apart section.

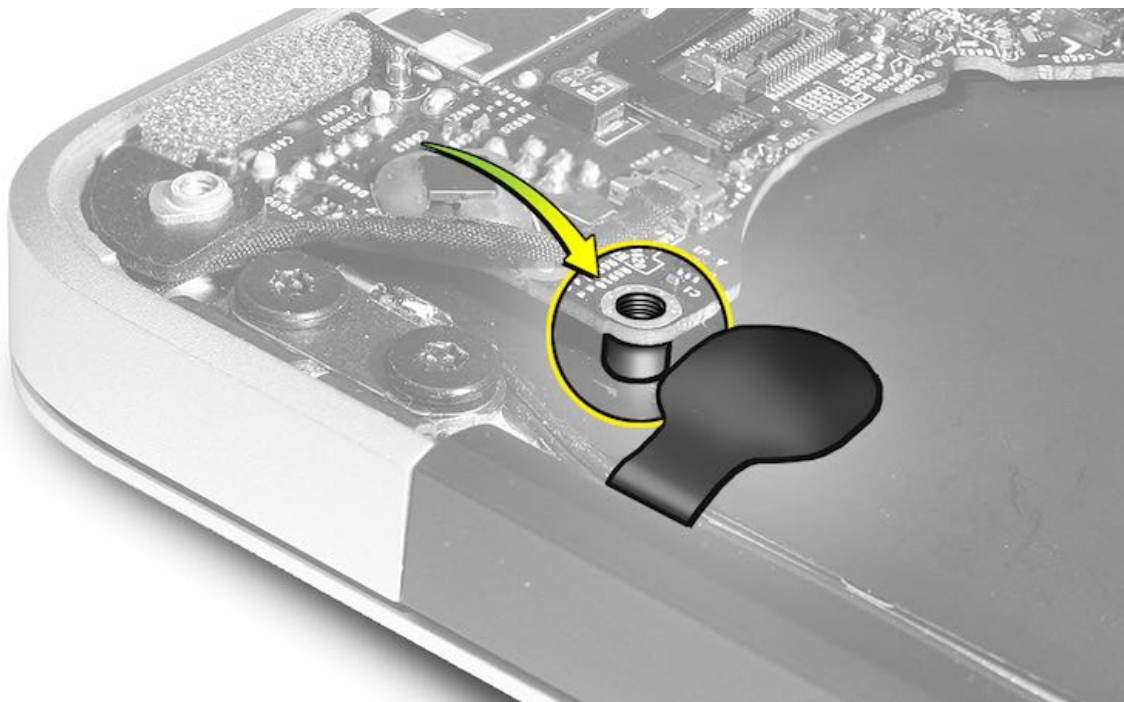


Cable Label Differences

A different label shape represents changes on the production line and does not affect product performance.

The service procedure is the same except for the cable label closest to the I/O board:

- If the cable label has no cutout, the label attaches next to, but not under, the I/O board.



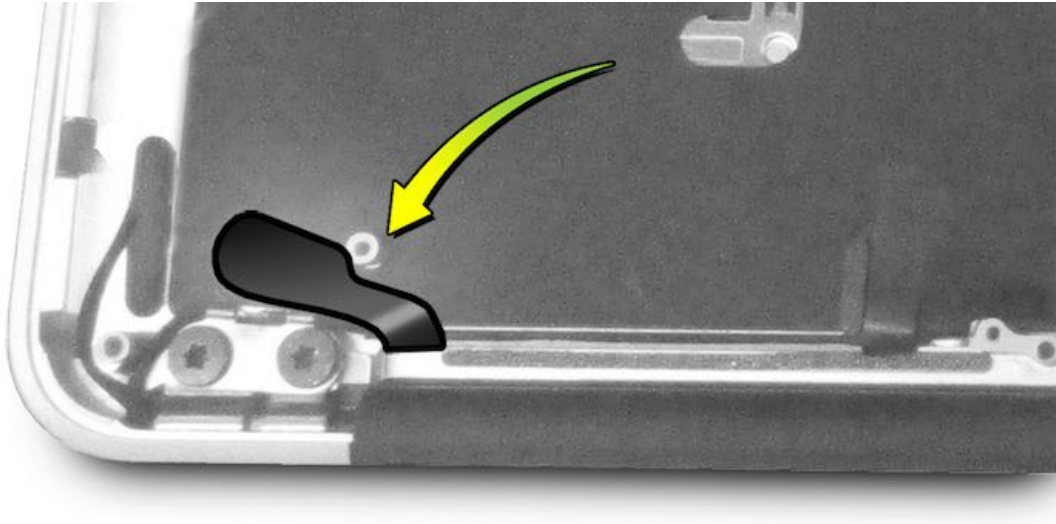
- If the cable label has a cutout for the standoff, you must remove the I/O board to attach the label over the standoff.



- **Mid 2013, Early 2014, and Early 2015 only:** If the cable label has a cutout for the standoff, you must remove the I/O board to attach the label **and foam spacer** over the standoff.



- If the cable label has no cutout for the standoff but fits between the display hinge and standoff, you must remove the I/O board to attach the label.



Steps For Reassembly

Reassemble in reverse order of removal steps.

Display Clutch Cover

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT202594: Exams for Service Technicians](#).

For video instruction, refer to article [SV191: Display Clutch Cover Replacement Video](#).

Remove:

- [Bottom Case](#)
- [Battery](#)
- [I/O Flex Cable](#)
- [SSD Card or Flash Storage](#)
- [Fan](#) (Late 2010, Mid 2011, and Mid 2012)
- [Fan](#) (Mid 2013, Early 2014, and Early 2015)
- [Logic Board](#) (with Heat Sink and AirPort/Bluetooth Card attached)
- [Display Clamshell](#)



Important: Immediately after removing the bottom case, always attach the battery cover and disconnect the battery cable from the logic board.

Caution: Read [Battery Safety Precautions](#) before performing this procedure.



Tools

- ESD wrist strap
- Clean, soft, lint-free cloth
- Black stick

- Clutch cover kit, 076-1374, that includes left/right adhesive strips (not shown)

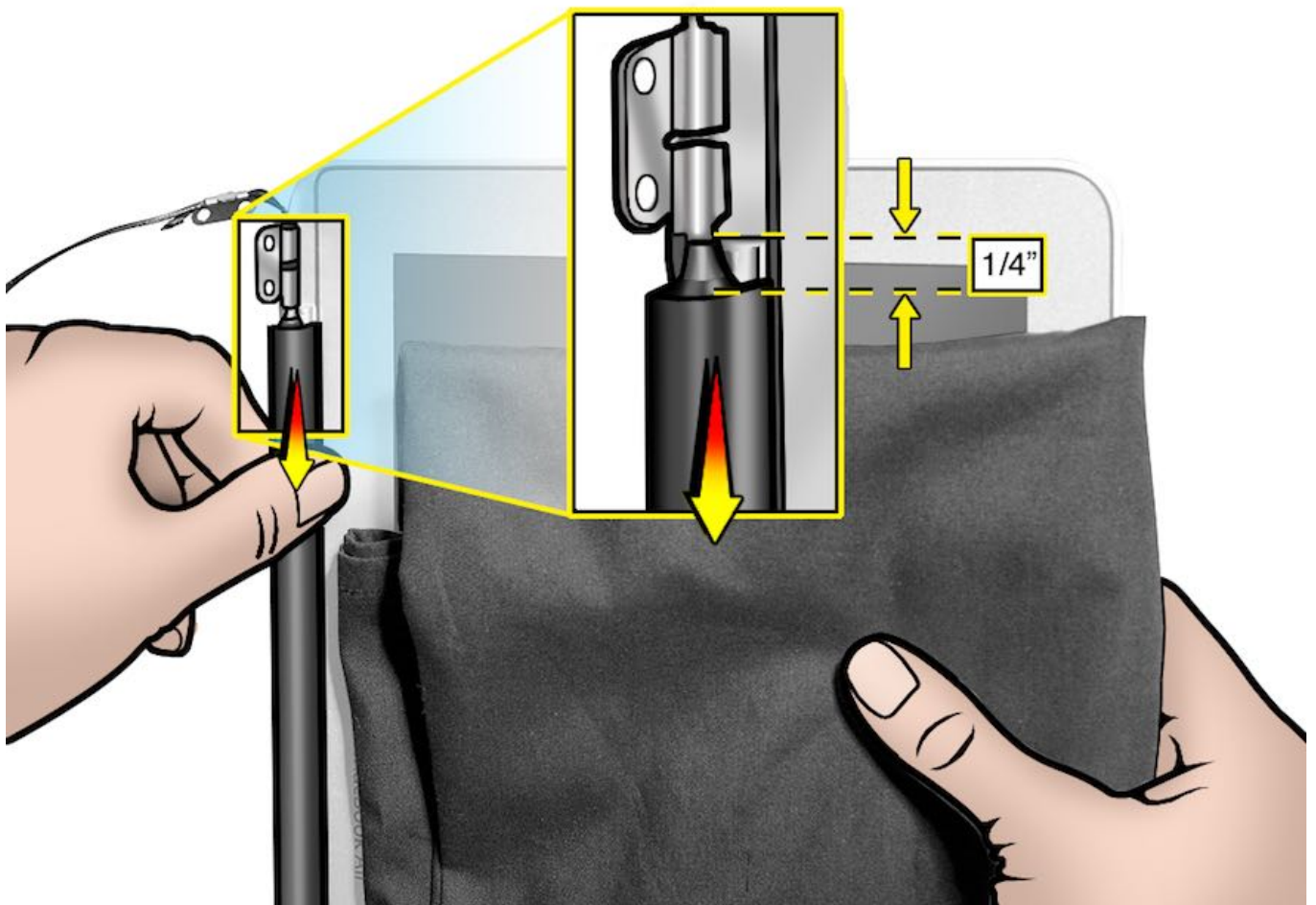


Steps For Removal

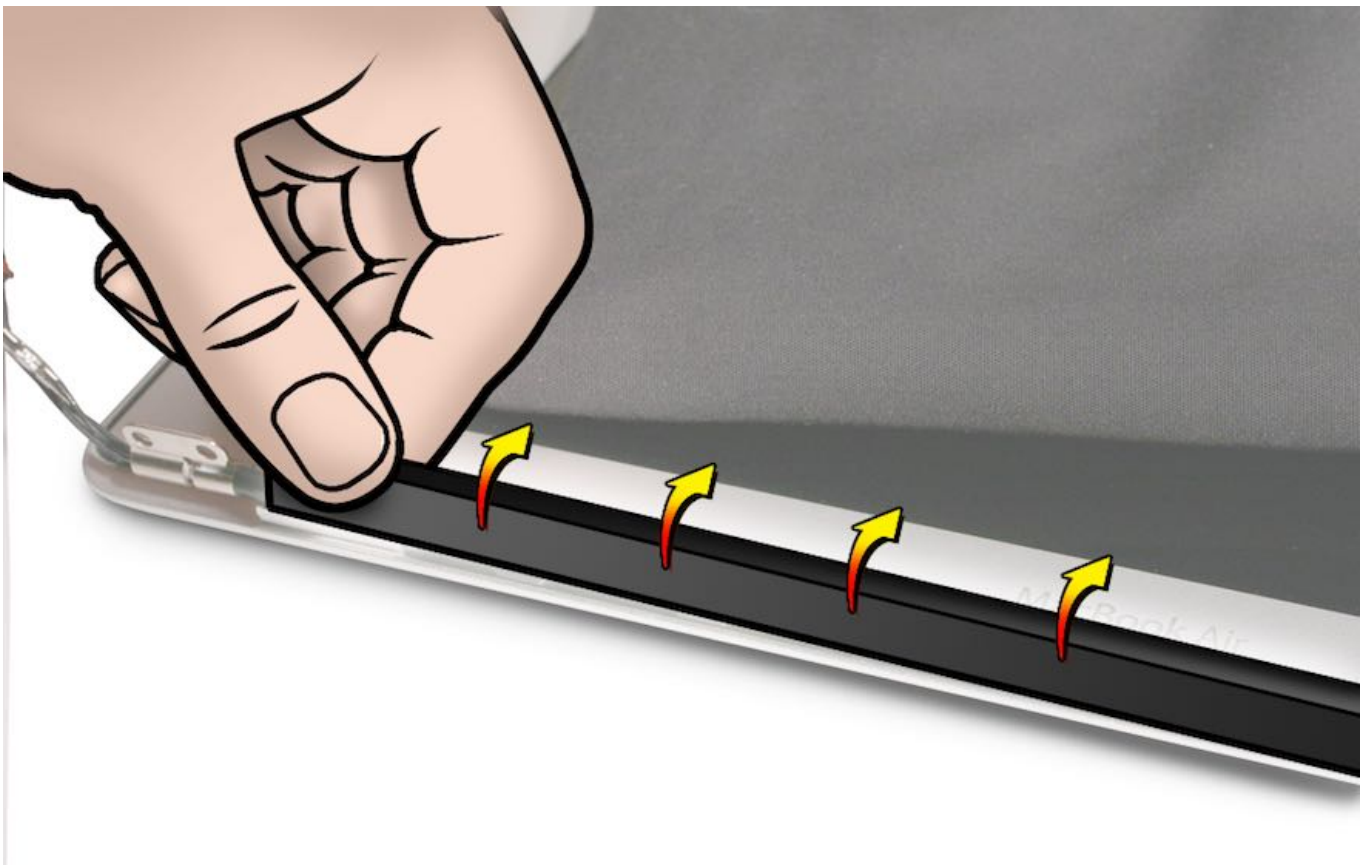
Note: Although this procedure shows some MacBook Air (13-inch, Late 2010) images, the steps are the same for the MacBook Air (11-inch, Late 2010, Mid 2011, Mid 2012, Mid 2013, Early 2014, and Early 2015) models.

1. Cover display face with clean, soft cloth, and hold it vertically.
2. Slide clutch cover 0.25 inch (6.35 mm) away from antenna cables.

Note: If clutch cover resists movement, insert a black stick in crease to loosen any adhesive on end of clutch.

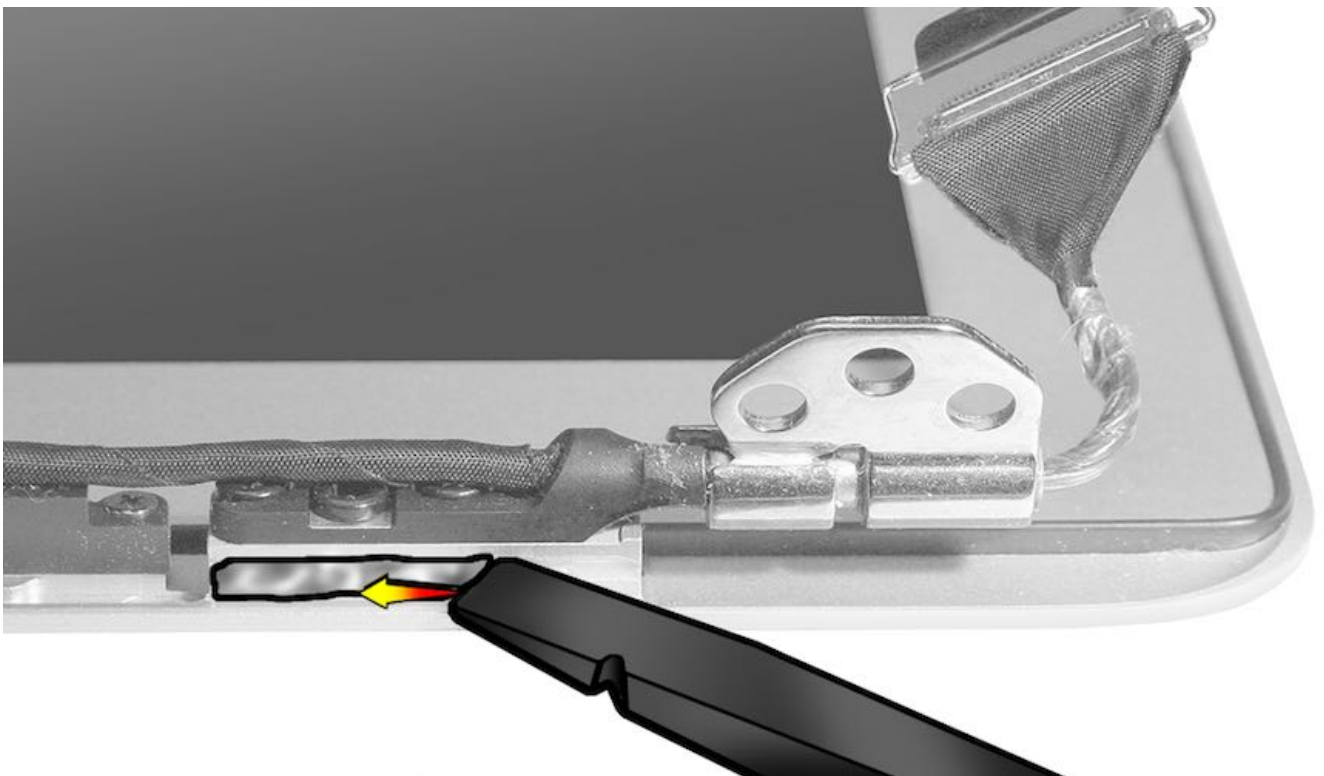


3. Place display clamshell on table.
4. Pinch and tilt up end of clutch cover as you **roll it toward display face**. Use a black stick to assist in clutch cover removal.
5. Remove clutch cover.

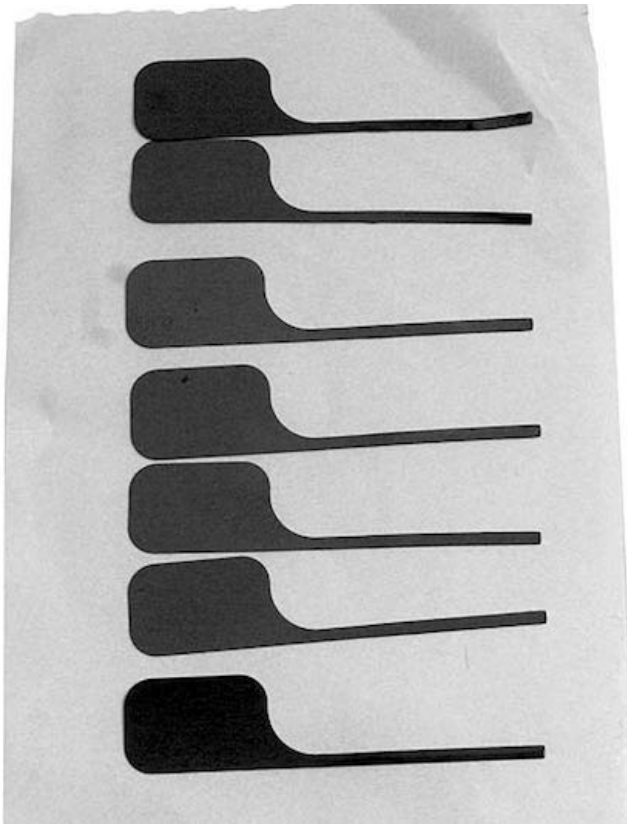


Steps For Reassembly

1. Clean residual very high bond (VHB) adhesive from both ends of display clamshell.

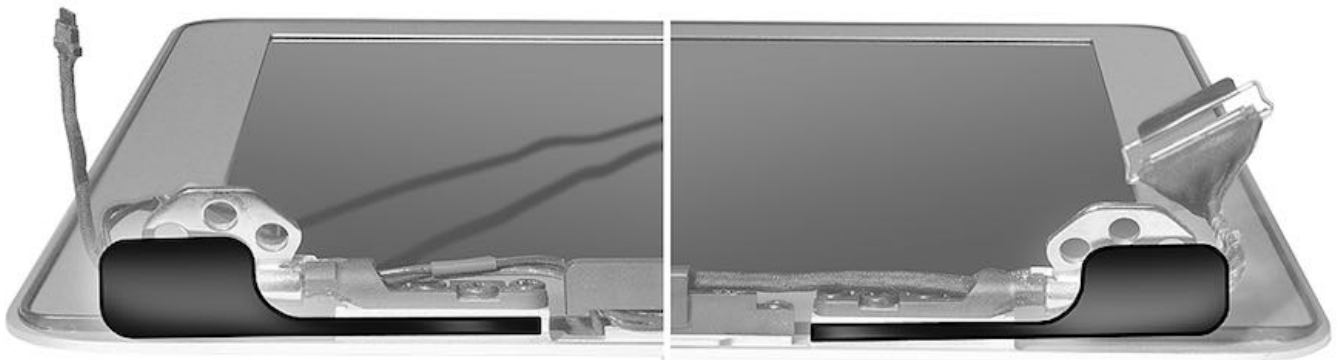


2. Notice right and left VHB strips. You will use **one** for each display hinge.



3. Apply one VHB strip to each hinge mount.

4. Keep strips in place as you install clutch cover.



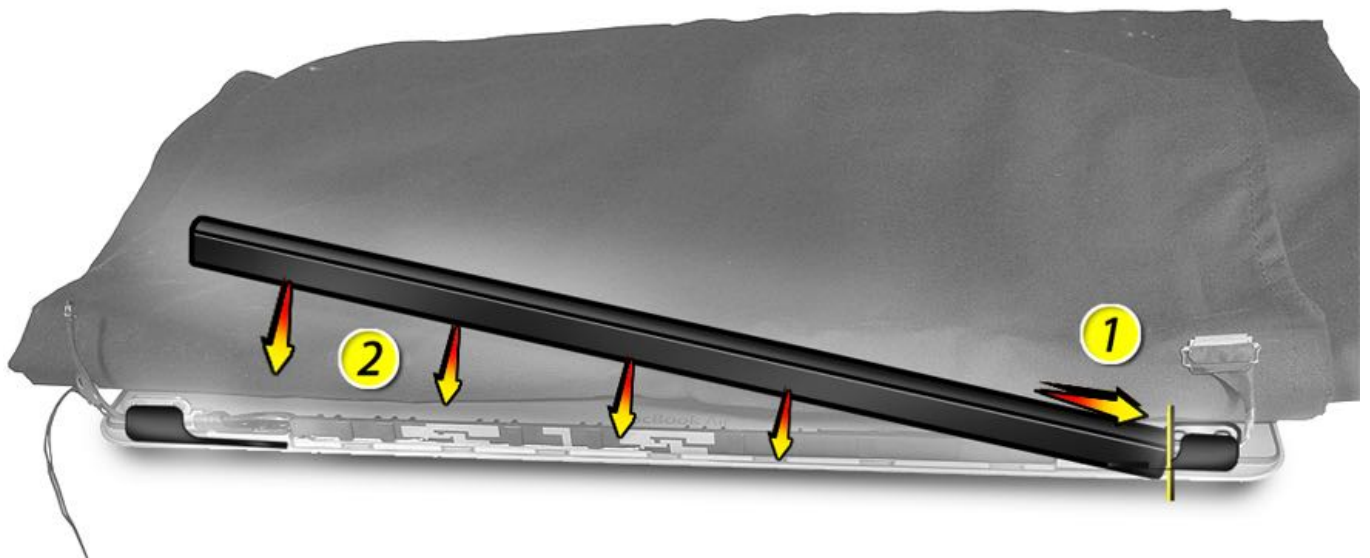
5. Note shape of clutch cover:

- Flat at bottom
- Curved at top

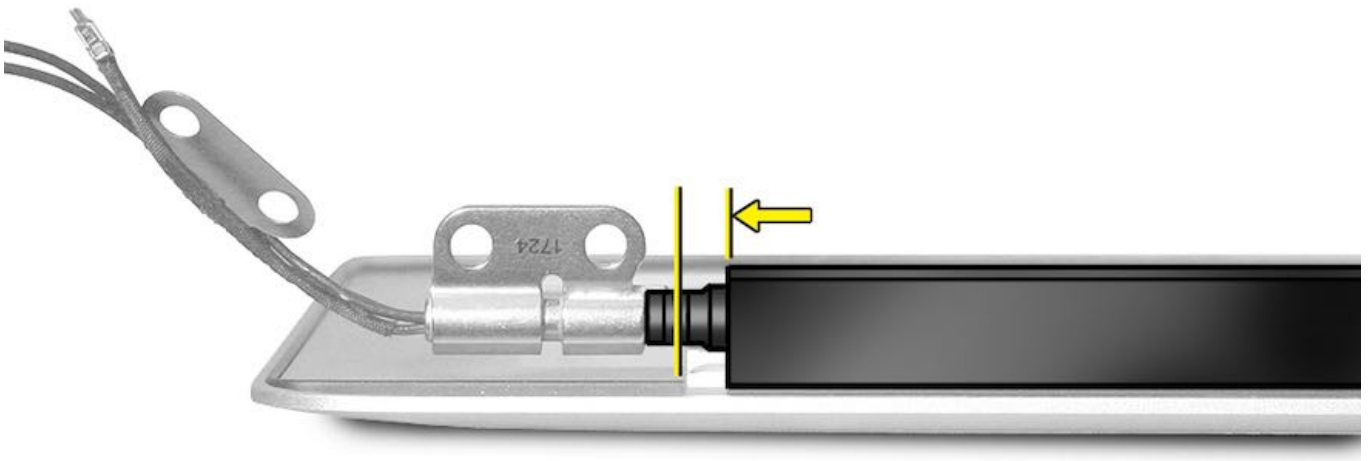
6. Make sure flat edge is at bottom of display.



7. Tilt clutch cover over right hinge mount.
8. Lower clutch cover onto display clamshell.
9. Listen for snapping sound as hooks engage.



10. With clutch cover engaged, slide it to the left to close the gap. (VHB strip not shown.)

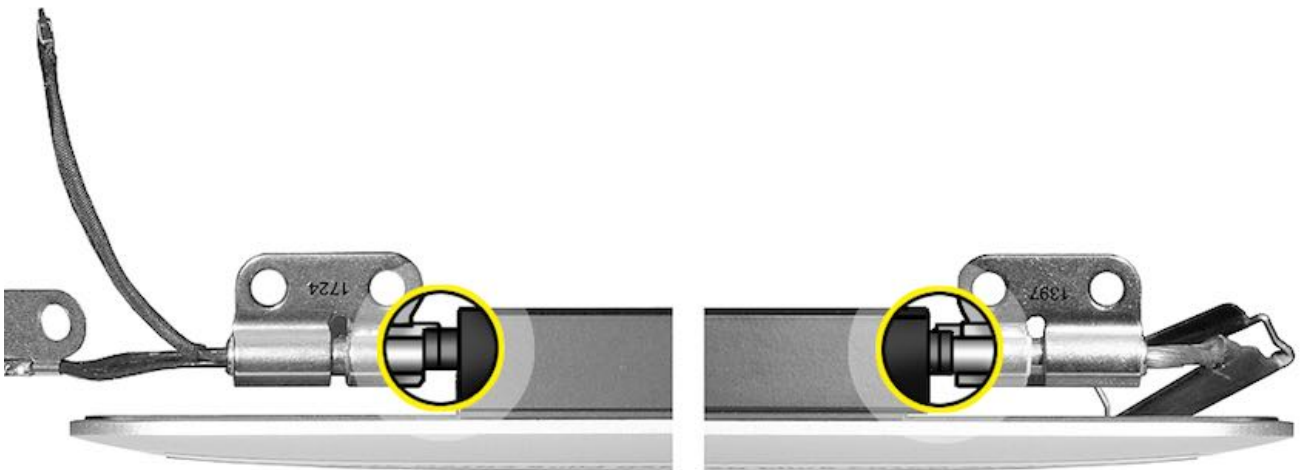


11. Check for good fit at both ends and across clutch cover.

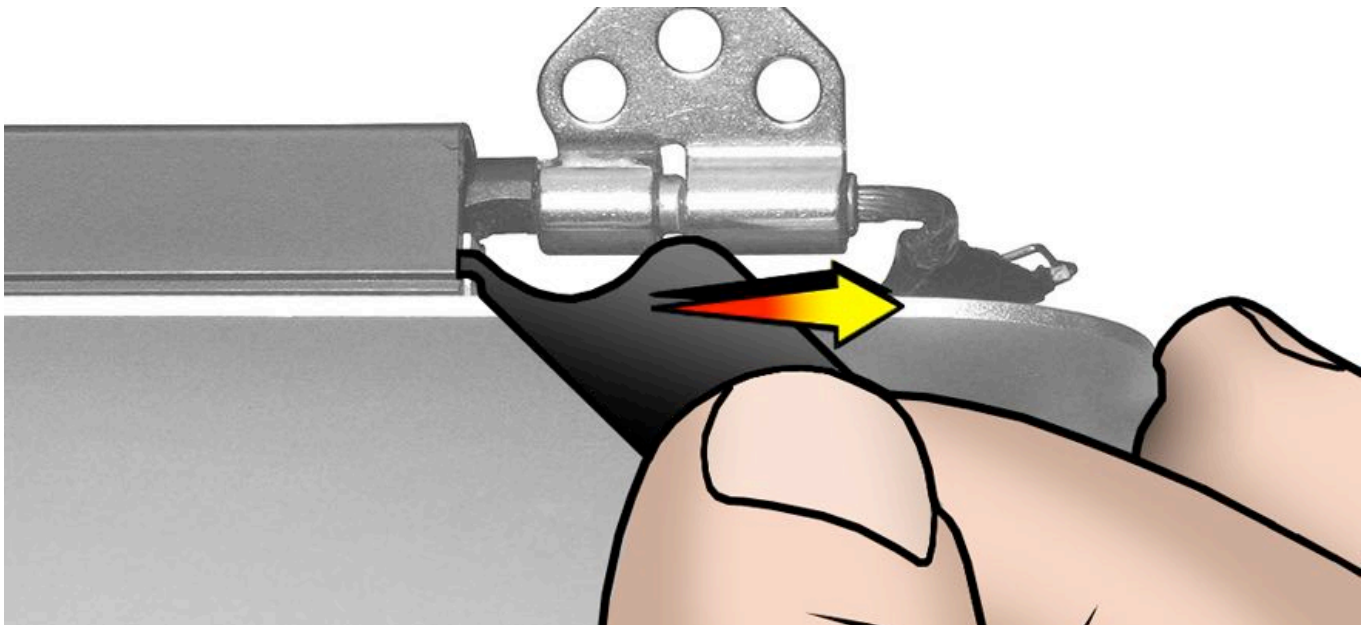
Avoid:

- Gaps
- Bulges
- Pinched cables

(VHB strips not shown.)



12. With clutch cover fully installed, pull exposed tab on each side to remove VHB strips.



Top Case with Keyboard

First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article [HT202594: Exams for Service Technicians](#).

For video instruction, refer to articles:

- [SV192: Top Case Replacement Video](#) (Mid 2012 and Mid 2013)
- [SV187: Microphone Replacement Video](#) (Mid 2012)

Remove:

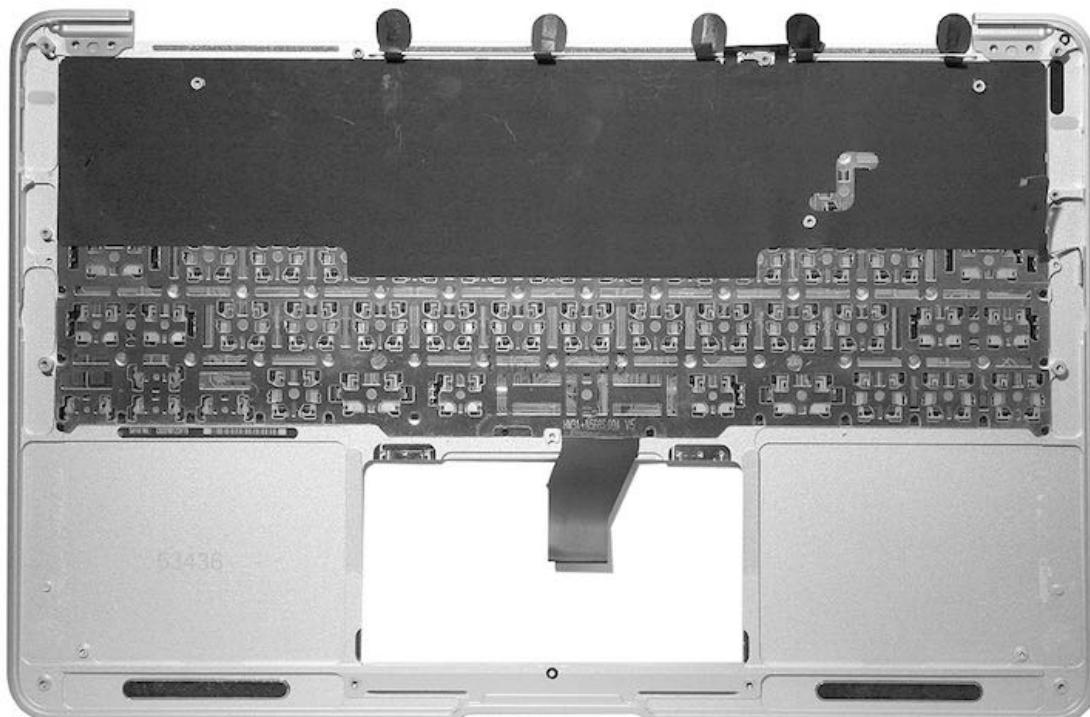
- [Bottom Case](#)
- [Battery](#)
- [I/O Flex Cable](#)
- [IPD Flex Cable](#)
- [Right Speaker](#)
- [Left Speaker](#)
- [SSD Card or Flash Storage](#)
- [Fan](#) (Late 2010, Mid 2011, and Mid 2012)
- [Fan](#) (Mid 2013, Early 2014, and Early 2015)
- [I/O Board](#)
- [Logic Board](#) (with Heat Sink and AirPort/Bluetooth Card or Wireless Card attached)
- [Trackpad](#)
- [Display Clamshell](#)



Important: Immediately after removing the bottom case, always attach the battery cover and disconnect the battery cable from the logic board.

Caution: Read [Battery Safety Precautions](#) before beginning this procedure.

IMPORTANT: It is recommended to use the Trackpad Keyboard Mapper after replacing the Mid 2013, Early 2014, or Early 2015 top case. For more information, refer to article [TP1016: AST Reference Guide: Using the Trackpad Keyboard Mapper](#).



Tools

- Heat gun
- Knife
- Permanent ink, fine-point pen

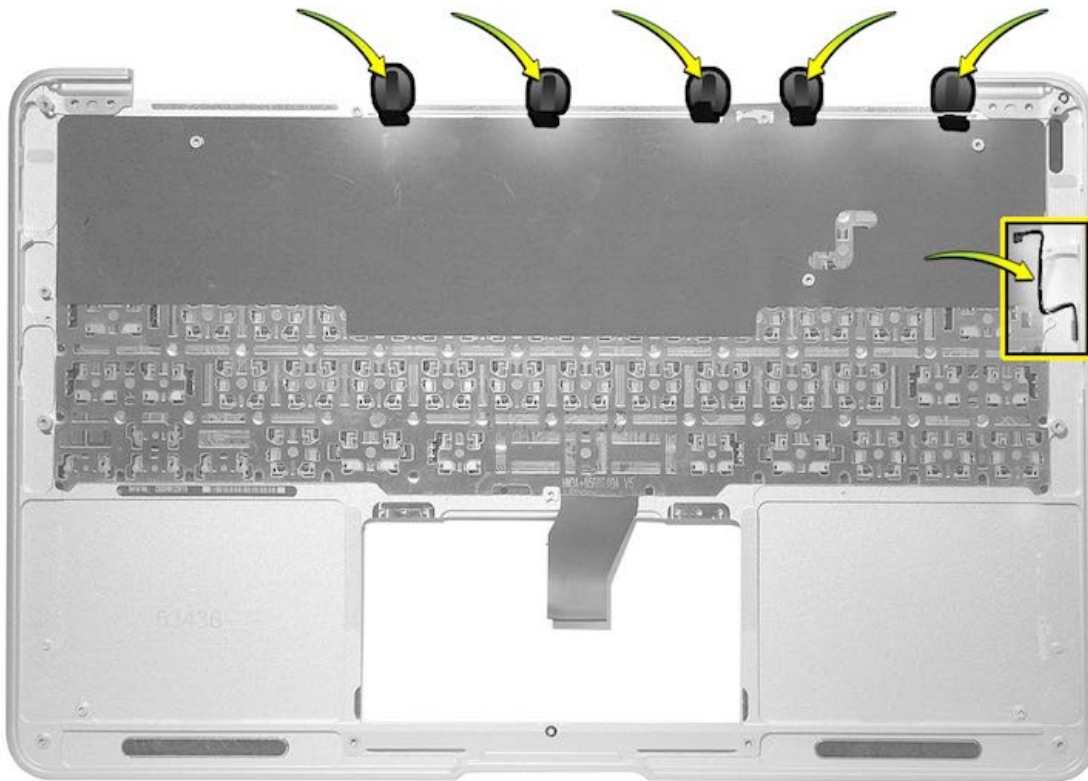


Steps For Removal

With first steps completed, top case is the remaining part. It includes these parts:

- microphone
- wireless cable labels

Late 2010



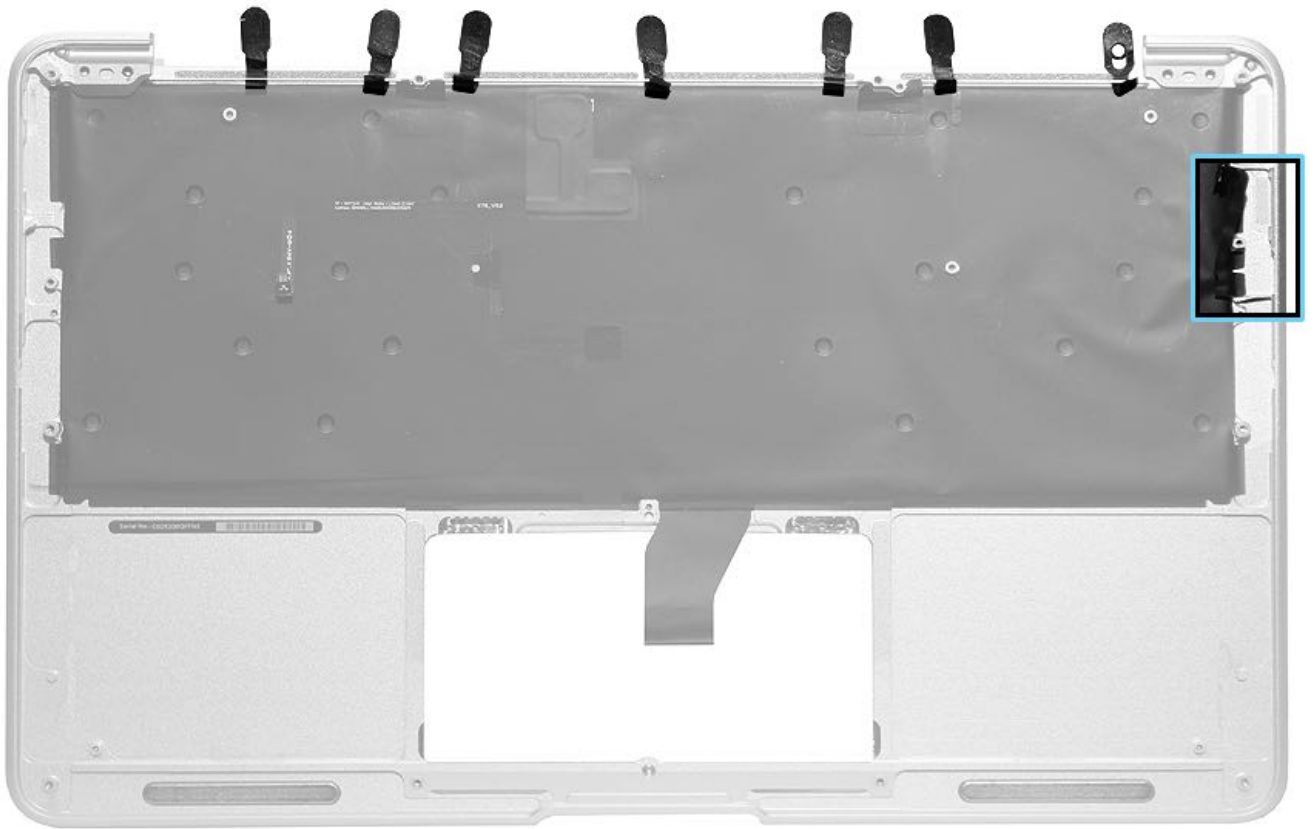
Mid 2011



Mid 2012



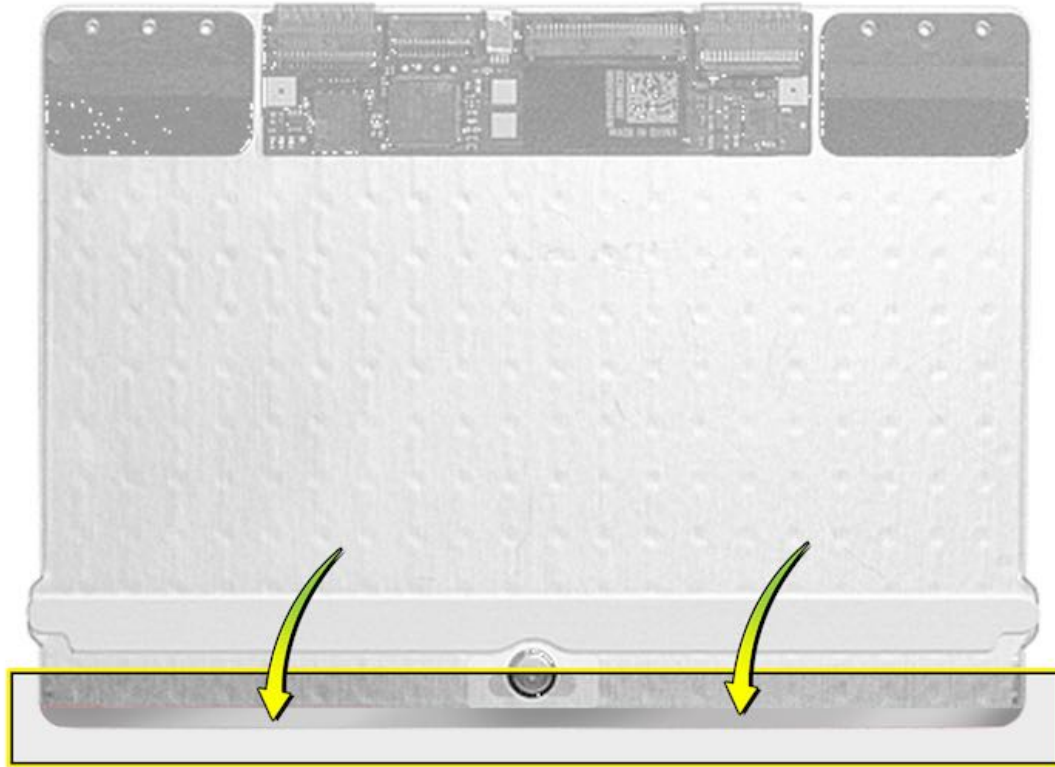
Mid 2013, Early 2014, and Early 2015



Steps For Reassembly



Caution: Be careful not to scratch exposed silver ink on lower edge of trackpad when installing trackpad into top case. Scratches create black spots and can be seen from user side of trackpad.

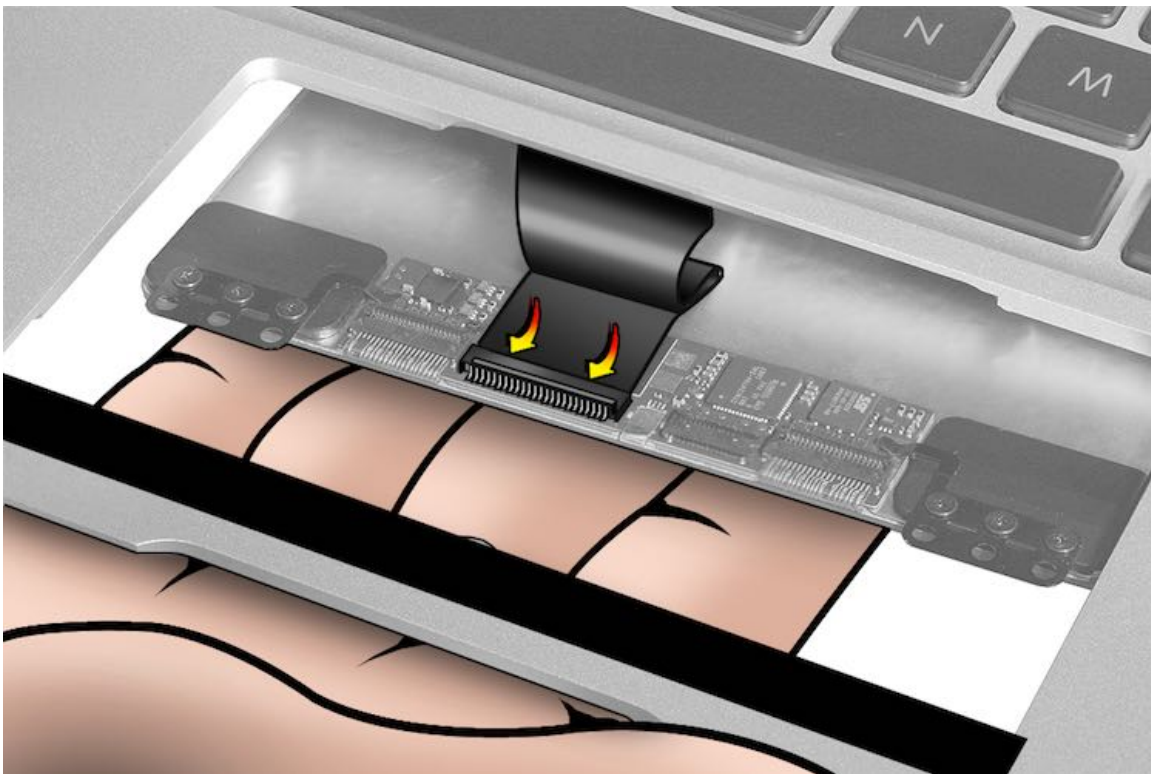


Replacement top cases have a strip of Mylar along lower edge of trackpad opening to protect exposed trackpad ink.



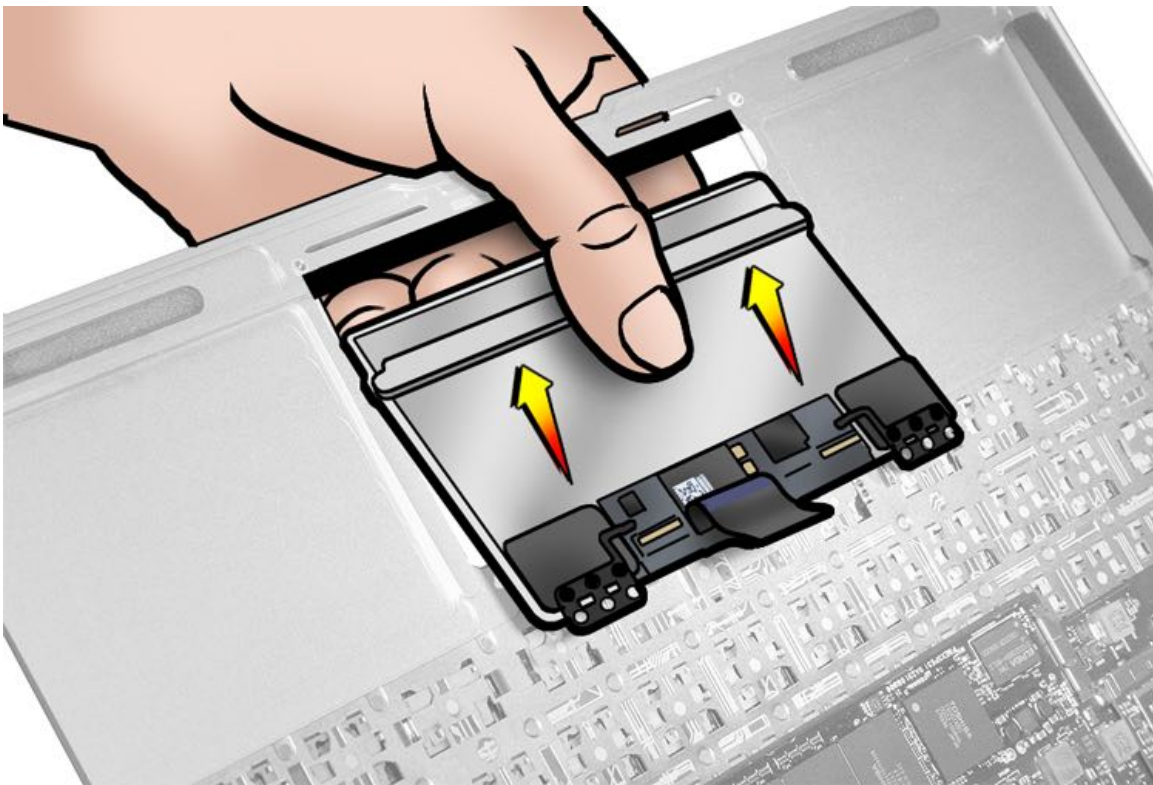
1. Tilt up top case, or place computer assembly on its right side with an open display, to connect keyboard flex cable to trackpad. Verify cable is seated properly before locking lever.

Note: If cable is already folded and sealed with very high bond (VHB) adhesive, skip steps 4 and 5.

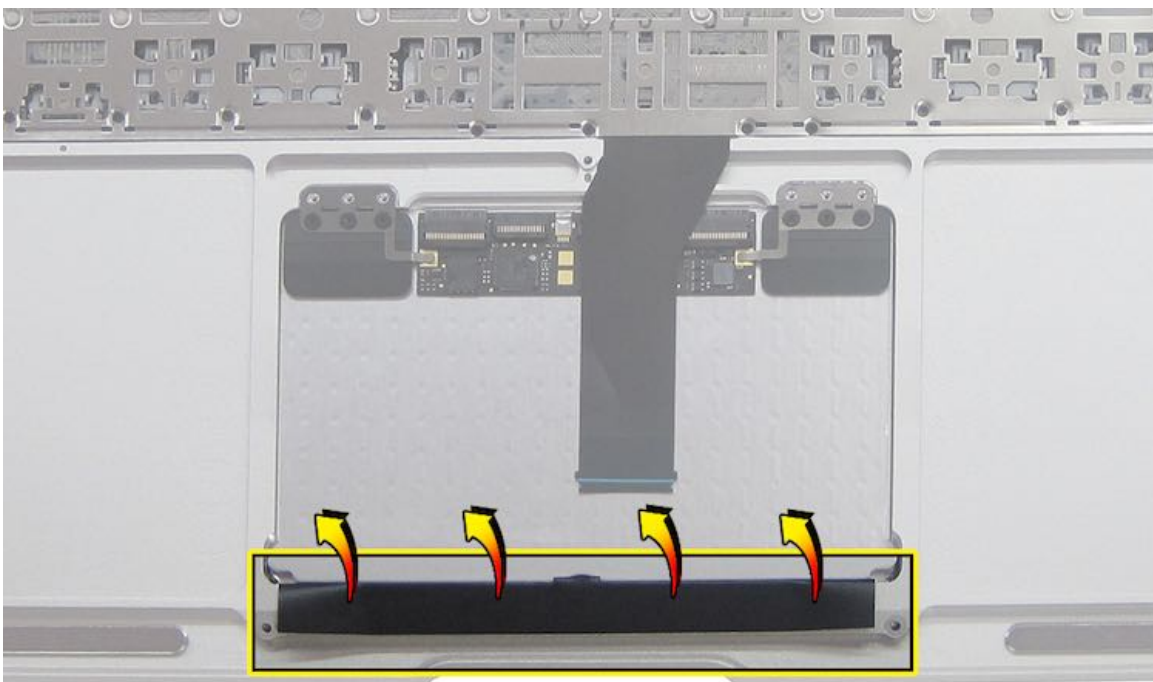


2. Carefully slide trackpad, lower edge first, into top case. Slide until trackpad seats inside opening.

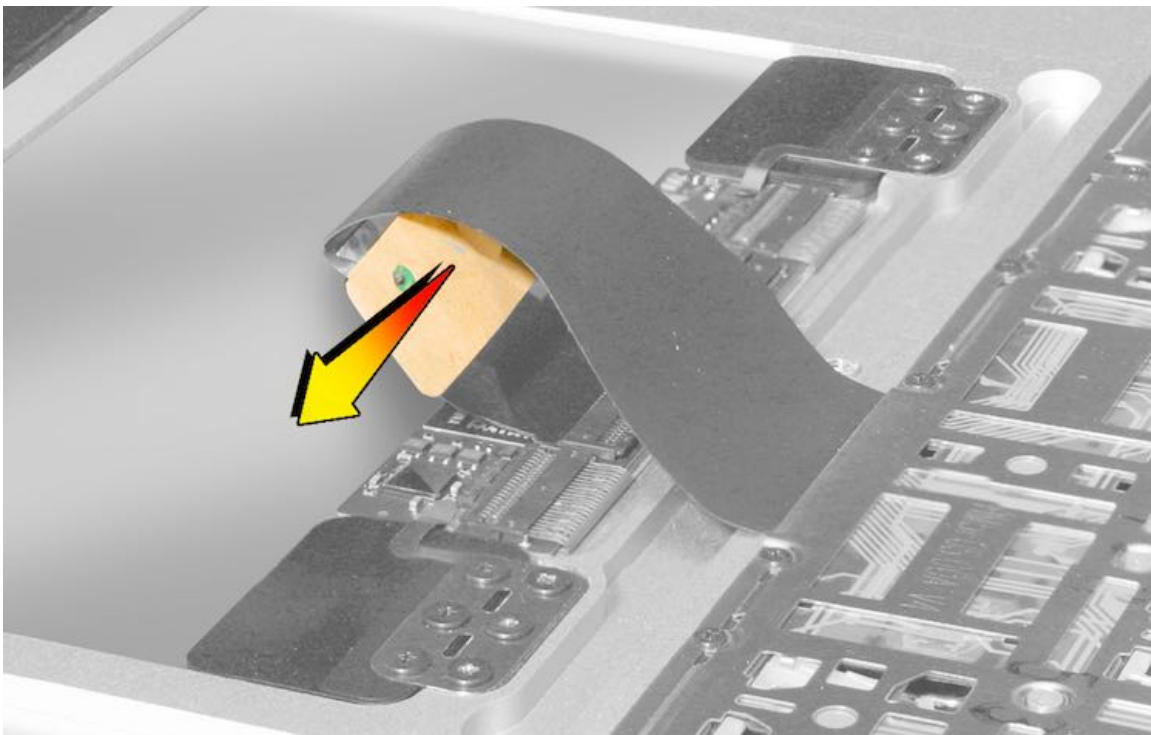
Caution: Minimize rubbing edges of trackpad against top case while installing. This could cause tiny cracks to form on trackpad.



3. Remove Mylar, including any pieces that may be caught between trackpad and top case.



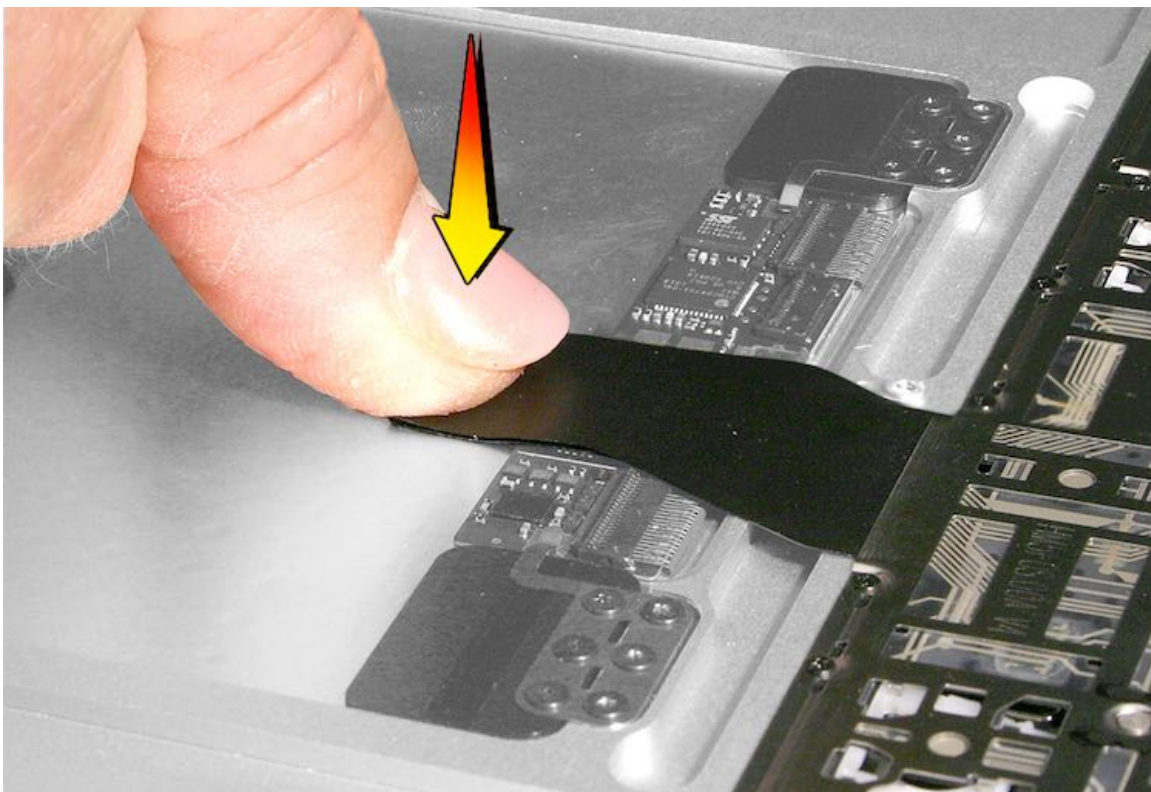
4. Peel paper backing from keyboard cable to expose VHB adhesive.



5. Press down firmly on keyboard cable for 15 seconds to:

- Flatten cable
- Adhere VHB to upper and lower surfaces of cable

Important: Keyboard cable **MUST** lay flat against trackpad. VHB adhesive holds bend in cable. If VHB or cable are compromised, trackpad alignment issues may occur. This may necessitate top case replacement.

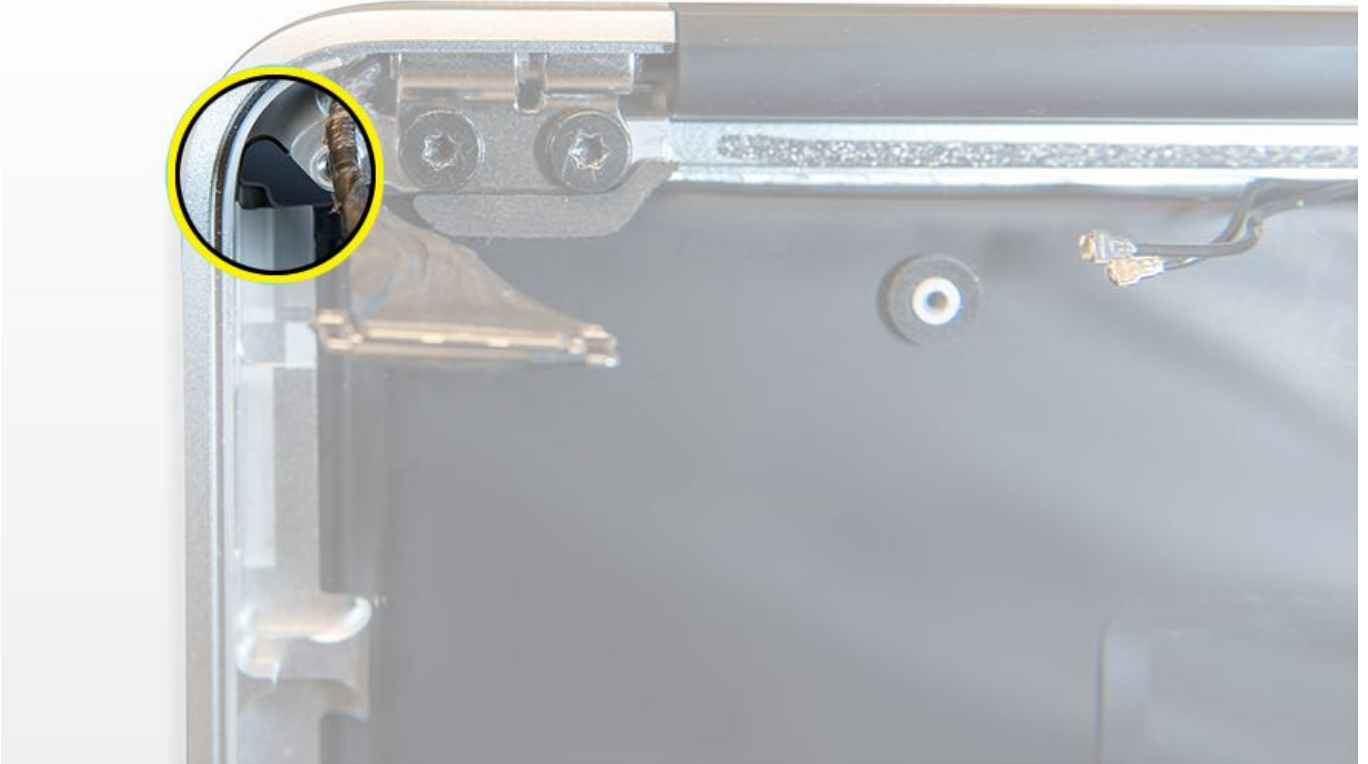


6. Replace trackpad screws, connect input cable, and align trackpad.

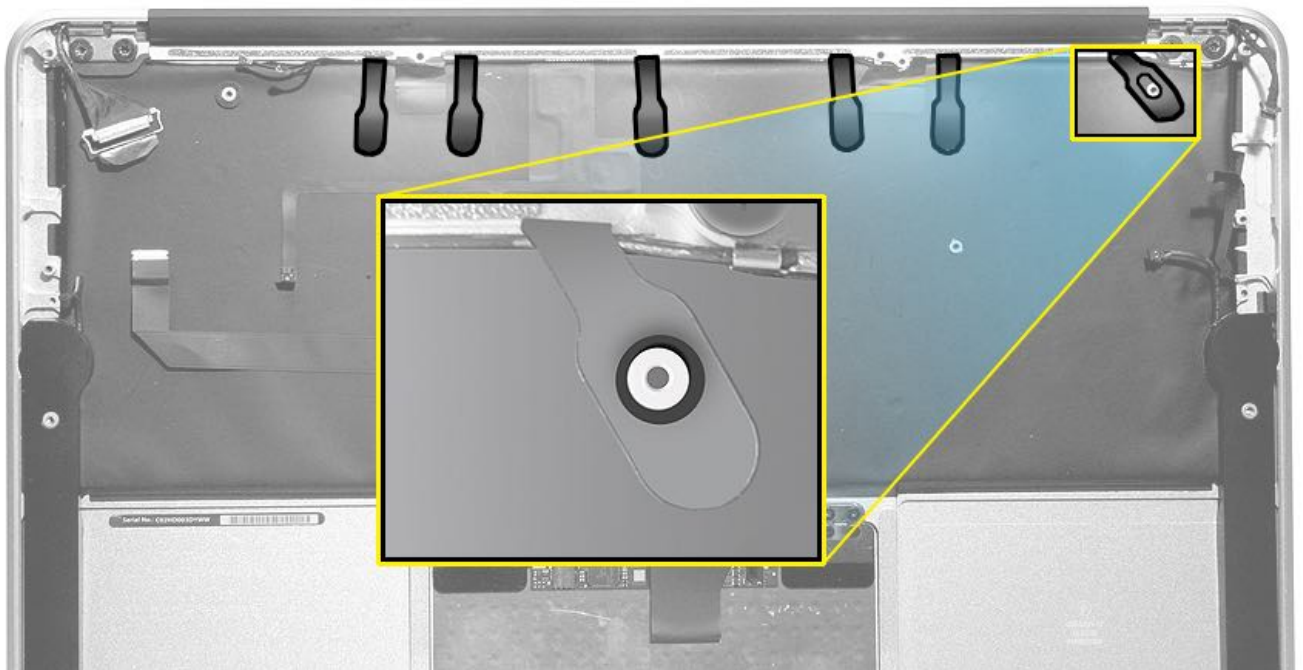
7. When installing a new top case, retain original top case until repair is complete.

8. **Note for Mid 2012, Mid 2013, Early 2014, and Early 2015 models:** In top case kit, along with trackpad screws and metal trackpad flexures, are two small parts: (1) a tiny, rubber bumper, and (2) a round, foam spacer. Refer to two images below to install these parts.

- Rubber bumper is placed in corner, near eDP cable. During top case replacement, remove adhesive backing on bumper and press it into place on top case.

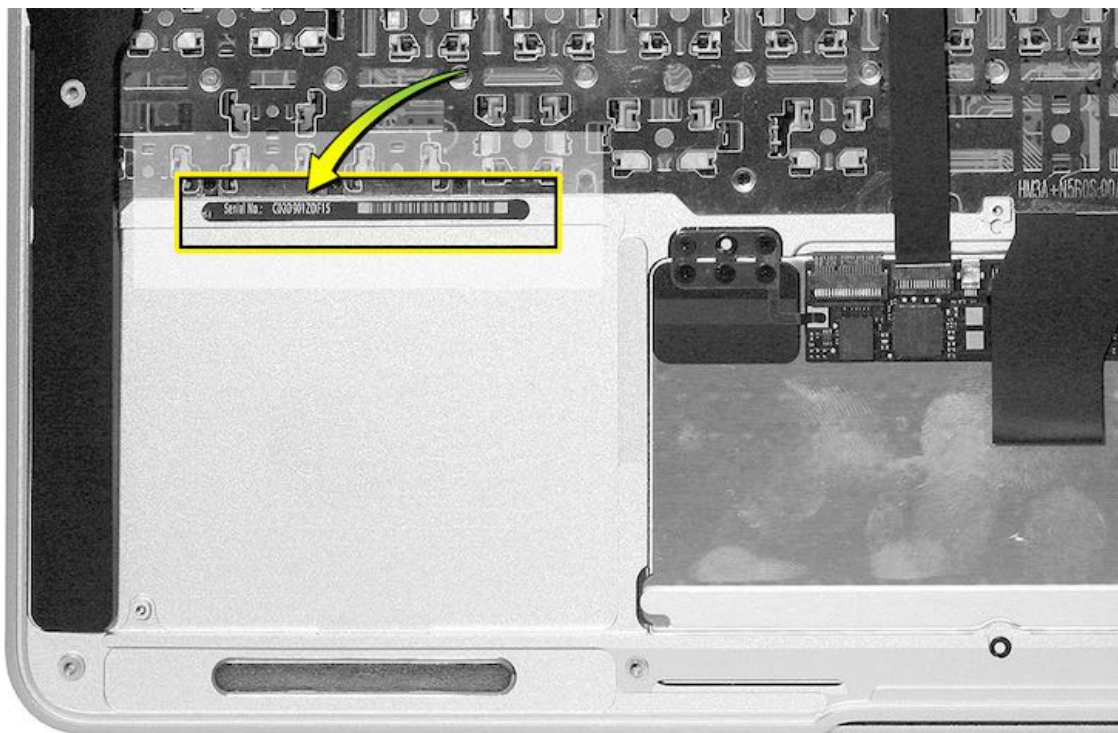


- Round, foam spacer is placed over wireless cable label located near I/O board. Peel adhesive off foam spacer. Place it over metal standoff, and on top of wireless cable label.

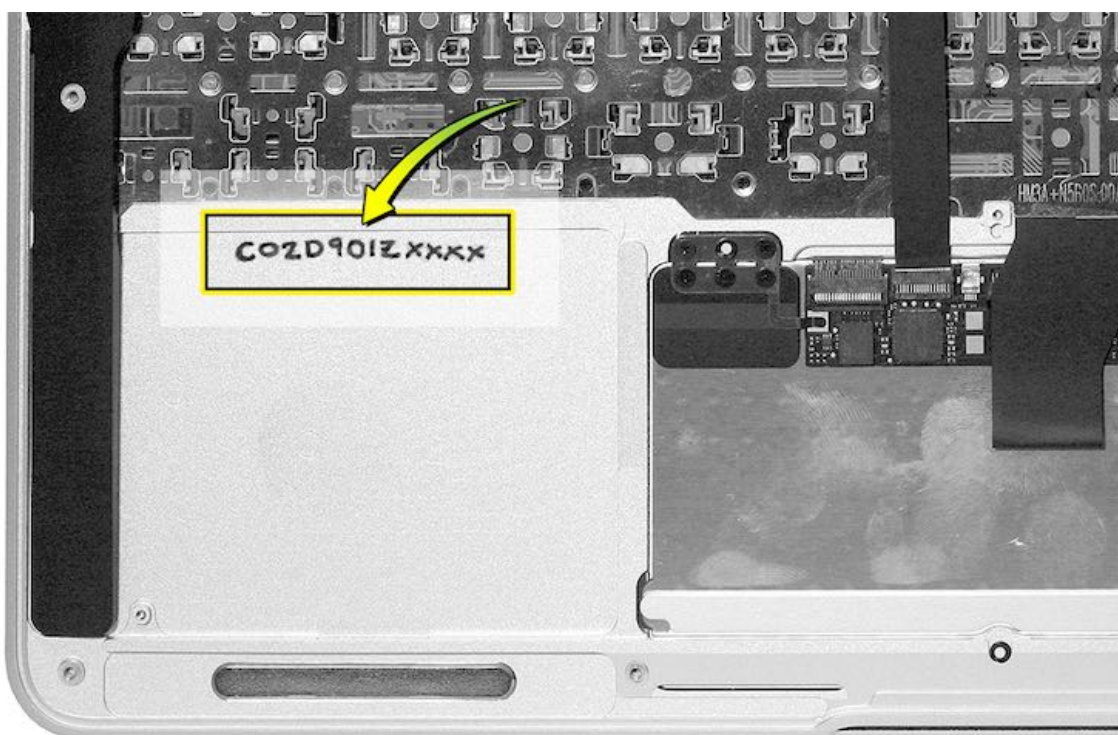


9. Before installing replacement top case, use a heat gun and knife to lift off serial number label.

10. Transfer label to inside of new top case.

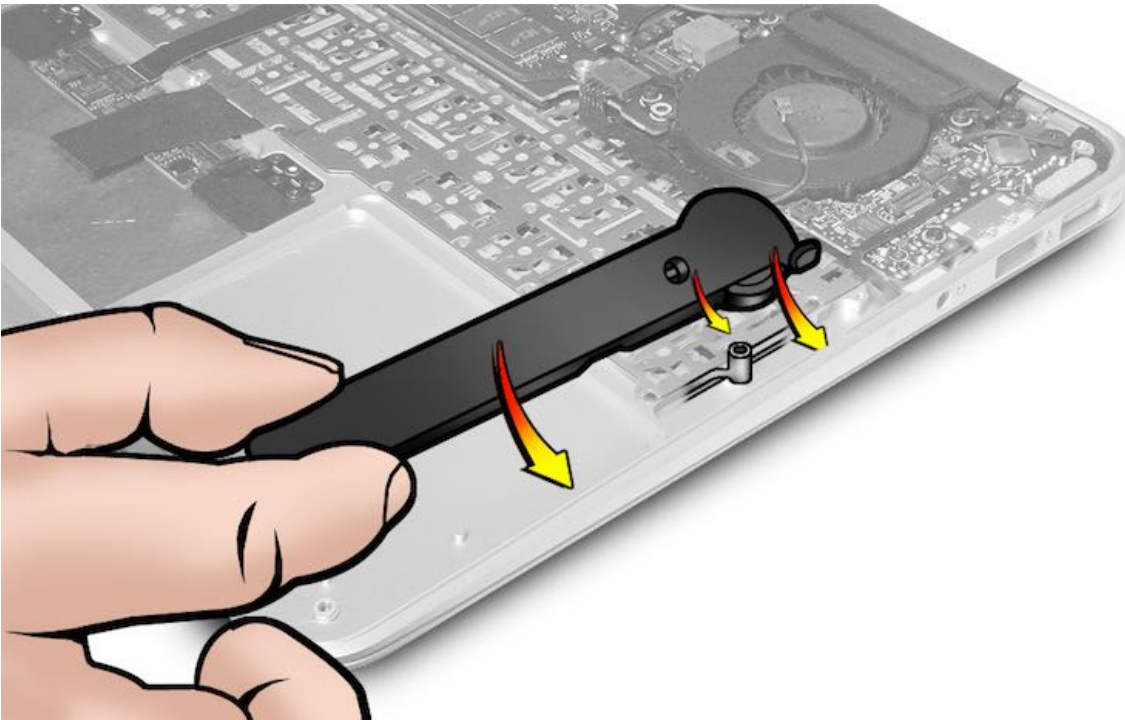


11. If label cannot be reused, use a permanent ink, fine-tip pen to write serial number on inside of new top case.



12. Install left speaker, making sure that only a single layer of adhesive is used.

Important: For left speaker to fit properly in the **Mid 2011, Mid 2013, Early 2014, and Early 2015** top case, it is important to clean off any adhesive or residual debris from bottom of speaker before installing it. Replacement top case comes with adhesive to hold left speaker preapplied in strips on top case. **Adhesive must lay flat in a single layer.** Do not double up speaker/top case adhesive.



13. **Important:** Use the Trackpad Keyboard Mapper after replacing the Mid 2013, Early 2014, or Early 2015 top case. For more information, refer to article [TP1016: AST Reference Guide: Using the Trackpad Keyboard Mapper](#).

If the trackpad is replaced and not programmed using the Trackpad Keyboard Mapper tool:

- Only basic or generic keyboard functionality may be available
- The keyboard may not operate correctly
- The keyboard backlight function keys may not control the keyboard backlight brightness

Apple USB SuperDrive

First Steps

Important: The following procedure is intended only for removing a stuck disc from an Apple USB SuperDrive at the user's request. Do not take apart an Apple USB SuperDrive for repair. The repair strategy for this product is Whole Unit Replacement.

This procedure requires placing SuperDrive upside down on its top case. Always use a clean, debris-free static mat to avoid scratches and other cosmetic damage to the housing.



Tools

- ESD wrist strap and mat
- Black stick (922-5065)
- #000 Phillips screwdriver
- T10 Torx screwdriver (later models)
- Suction cup (922-8252)



Steps For Removal

Because this is a handheld procedure, perform these steps over a workbench or elevated repair surface to minimize height from which a component might fall.

1. Hold SuperDrive securely in one hand by edges of silver top case, with black bottom case facing up and USB cable leading away from you.



2. With other hand, place suction cup on center of bottom case. Press down firmly to flatten and secure suction cup.

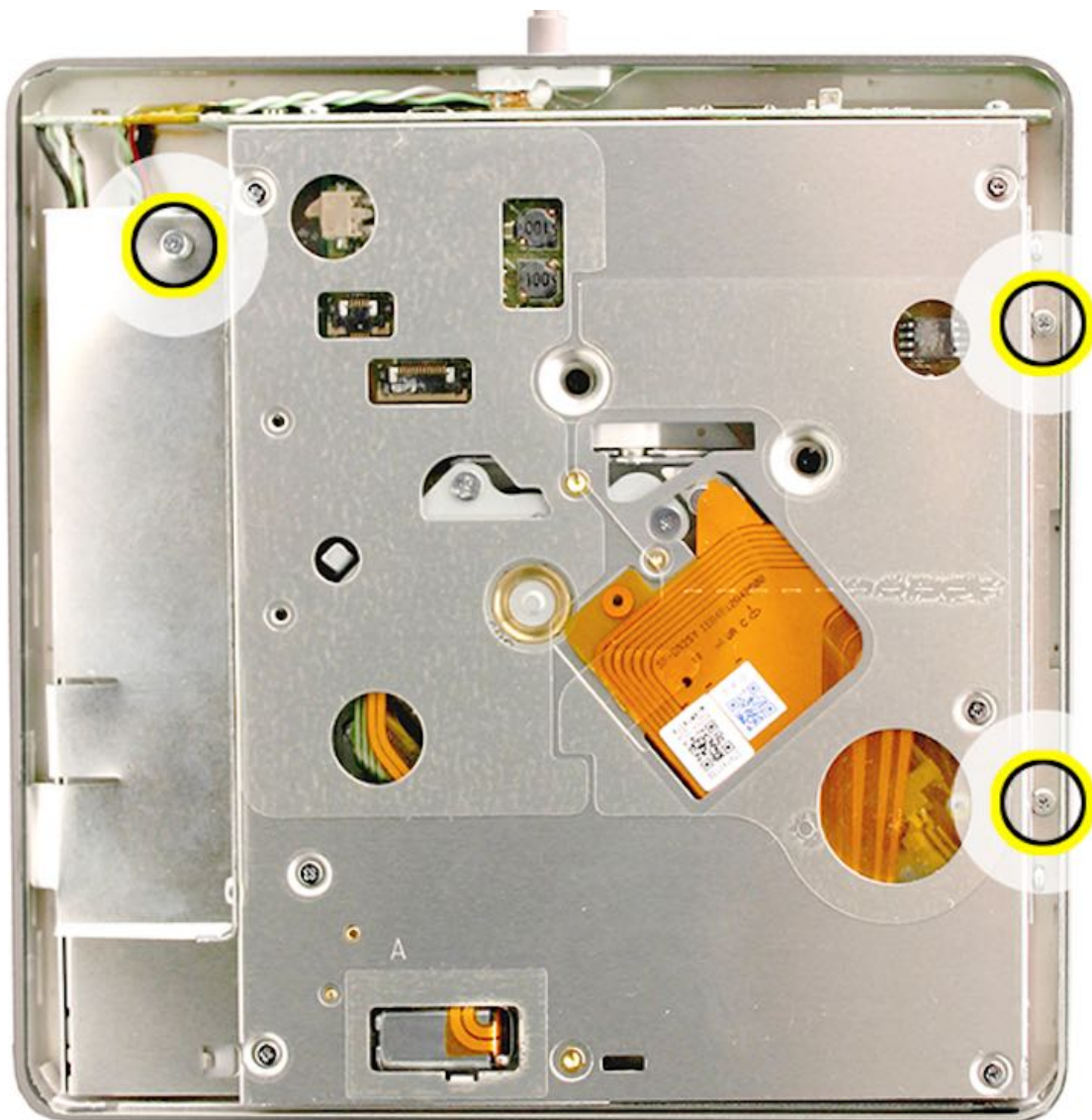


3. Once suction cup is fully adhered, lift straight up. Pull bottom case directly out of top case in one smooth motion. Secure fit might give a lot of resistance.

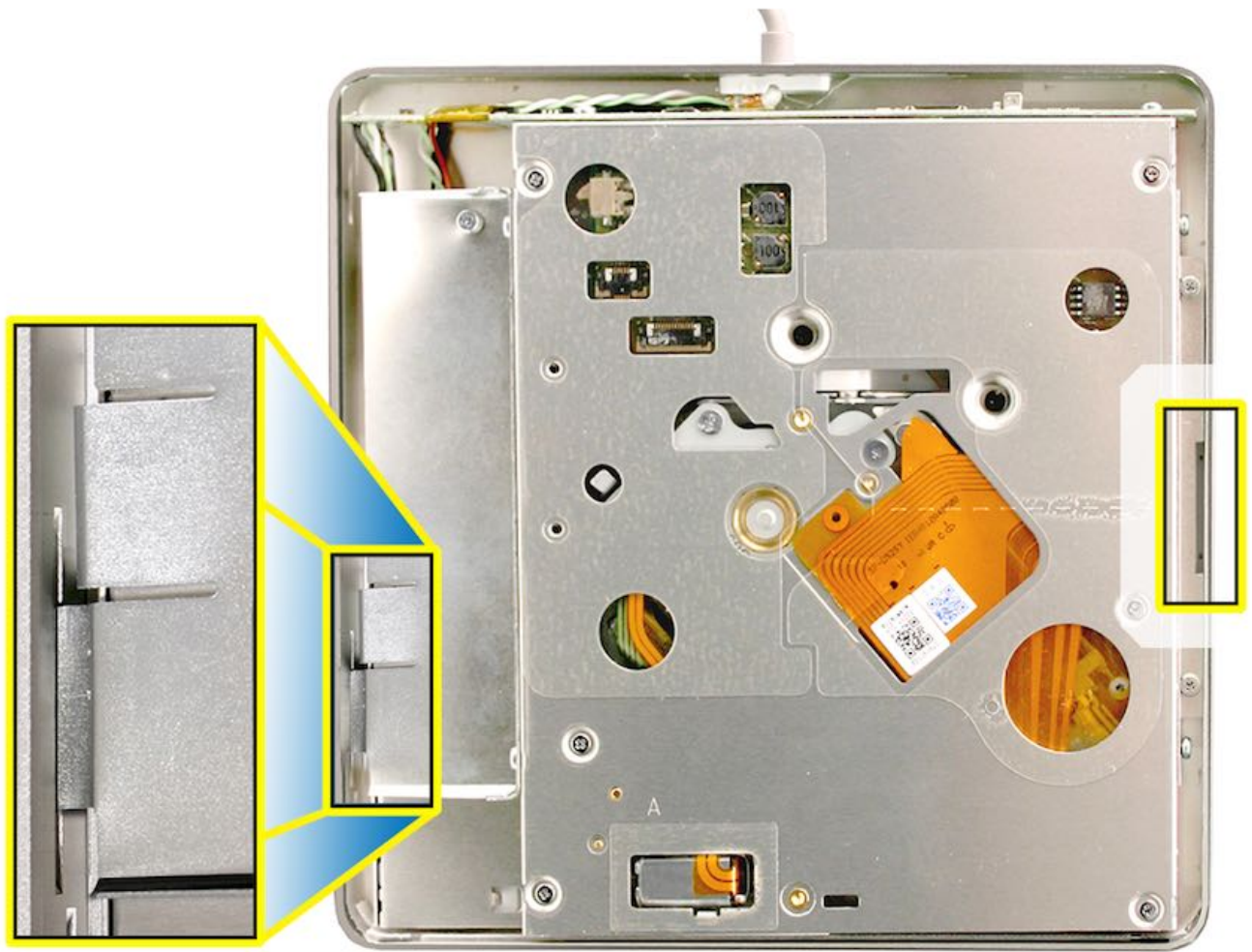
Important: Adhesion of suction cup is short-lived. To avoid damage from dropping, immediately set bottom case on a clean surface. Be mindful of tabs.



4. Set drive top-down on a soft, clean surface, with inside facing up and USB cable leading away from you. Remove three #000 Phillips screws (shown below).



5. Note tab on lower left of drive fits into recessed slit on inside edge of top case (see below left). On opposite side of drive, note gap in center of right edge of drive (see below right).



6. Insert flat edge of black stick into gap on right edge of drive. Carefully pivot edge upward slightly, just enough to slide drive a few millimeters right. Ease left tab out of top case.



7. Note internal cable leading to external USB cable. In earlier model you will see a controller board connected to cable (see inset below).

Caution: Since cable remains connected during this procedure, be careful not to pull or stress cable connections. To avoid

damaging cable, always keep drive within an inch or so of outer case.

8. Grip drive by edges. Avoid touching components. Lift drive up and out of top case a few millimeters — enough to pivot and flip drive over.



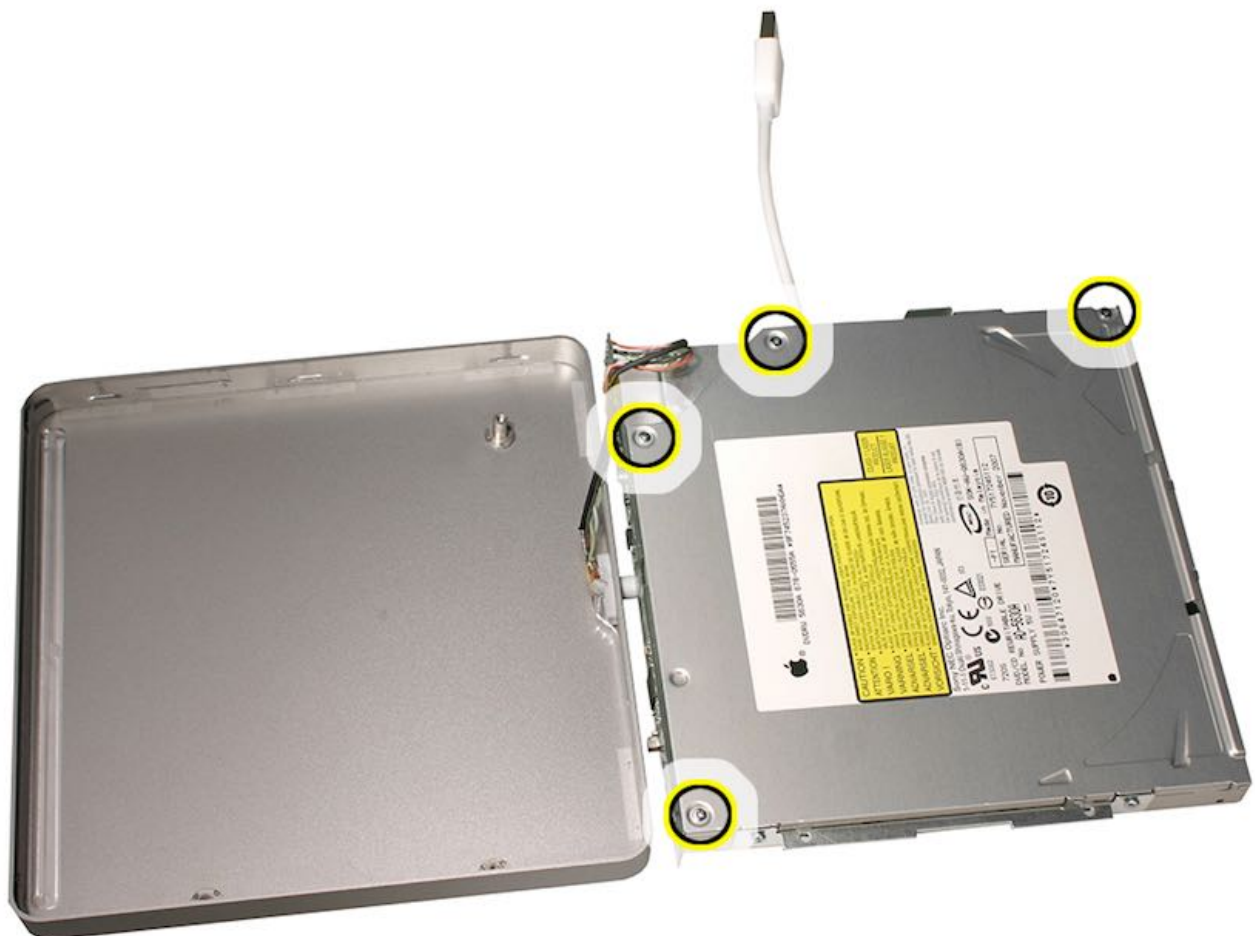
9. As if opening a book, flip drive up and over. Gently lay it down, keeping edges as close together as possible to avoid straining cable connections.



10. Immobilize drive while removing screws or components, holding drive by bracket or edges only.



11. Remove four #000 Phillips screws from top of drive (shown below).



12. Remove two T10 screws or two Phillips screws (depending on model) holding bracket to drive.

Earlier model:



Later models:



13. Lift top lid of drive, pivoting right edge up. Then shift lid left and downward to remove left edge.



14. Remove stuck disc. Reassemble SuperDrive in reverse order of previous steps 4-13. Proceed to step 15 to correctly reinstall bottom case.



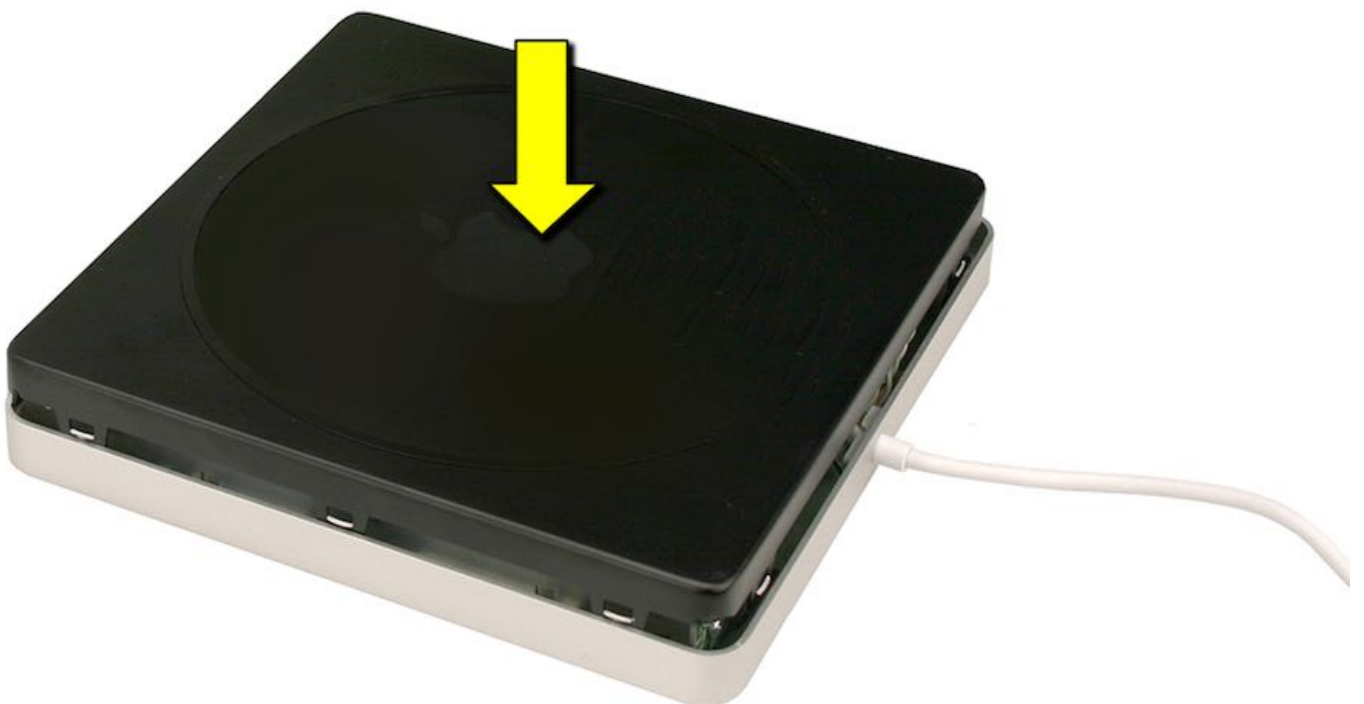
15. Orient bottom case to top case, as pictured below. Note three tabs per side on left and right sides of drive and two corner tabs in back. There are no tabs in front (where disc slot is located).



16. Set bottom case evenly on top case with tabs just inside perimeter of top case edge. Align all tabs with top case.

Note: If case is oriented correctly, Apple logo will be right-side up when USB cable is pointed toward you.

17. With firm, even pressure, snap bottom case into top case to seat tabs. Verify all tabs are fully seated and SuperDrive sits flat.



Steps For Reassembly

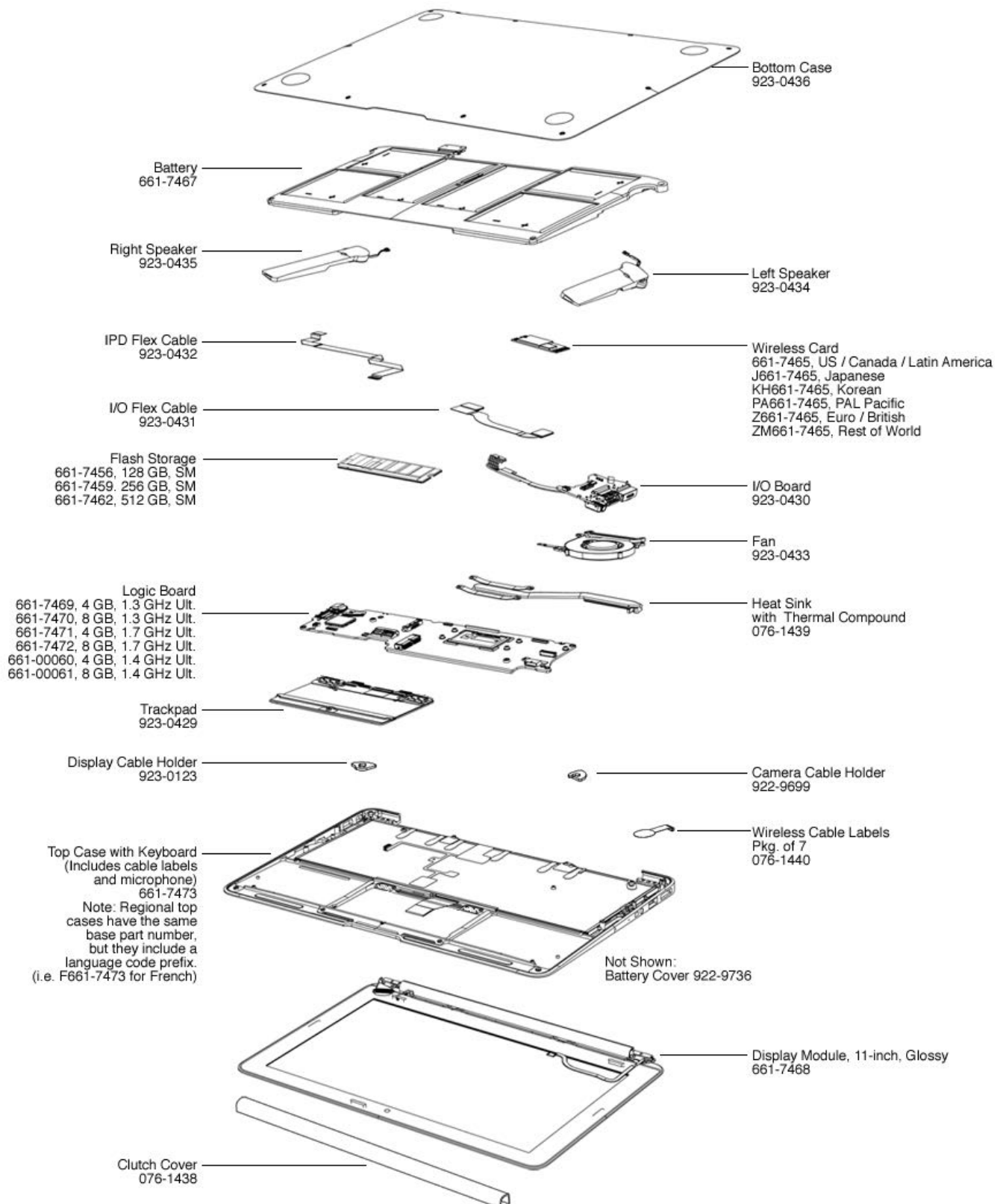
Reassemble in reverse order of removal steps.

Quick Test

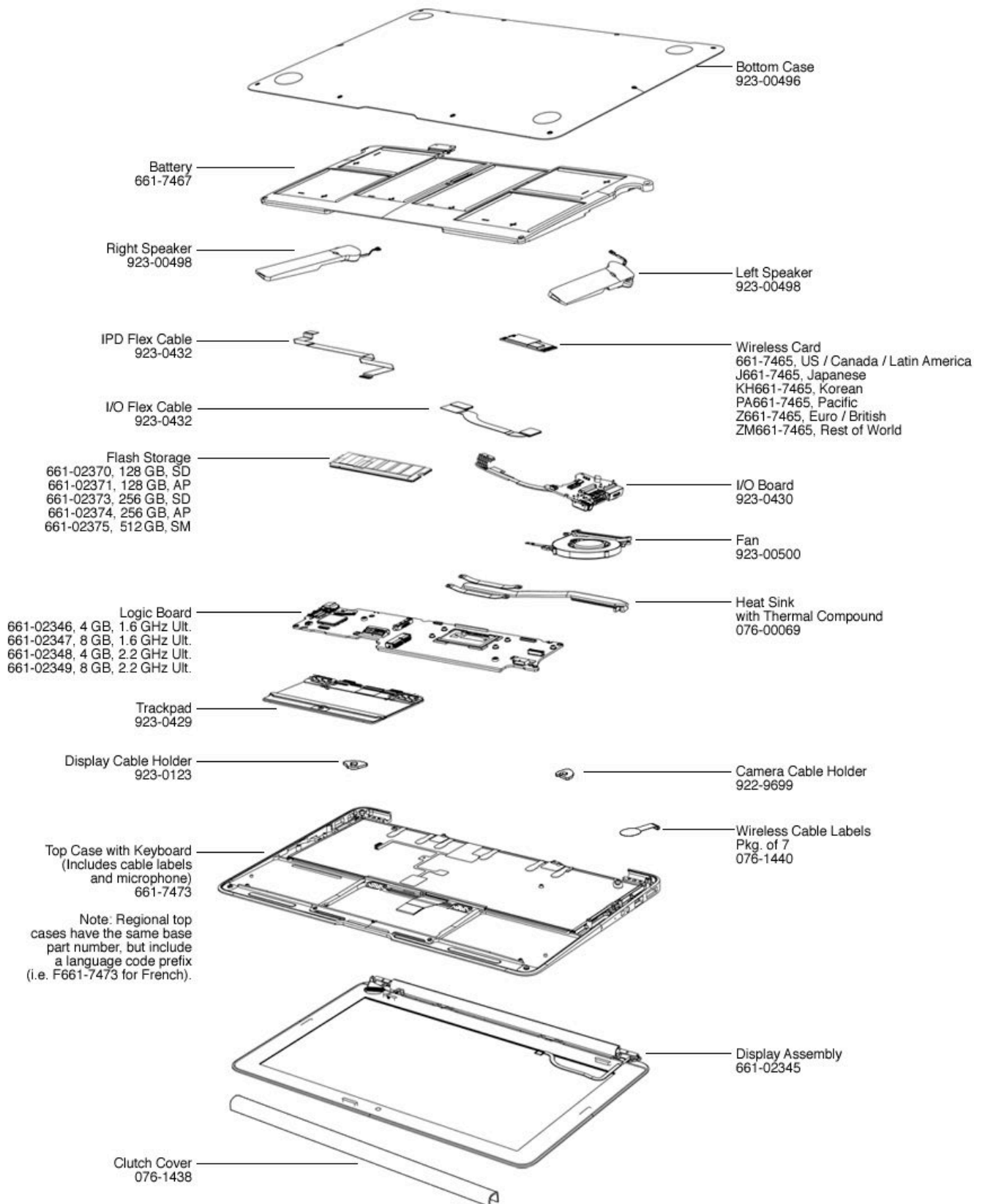
Plug Apple USB SuperDrive into known-good computer to check functionality. Check drive for disc insertion, mounting, and ejection of a variety of optical media.

Exploded View

MacBook Air (11-inch, Mid 2013 and Early 2014)



MacBook Air (11-inch, Early 2015)





Not Shown:
Clutch Barrel, 076-1438
Power Adapter, 45W 661-00529; AR661-00529, Argentina; LA661-00529, Latin America; MY661-00529, Malaysia; PA661-00529, Pacific
Power Cord, 922-9173 Note: Regional power cords have the same base part number, but include a language code prefix (i.e. J922-9173 for Japan).

Screw Chart

Screw Chart for MacBook Air (11-inch, Late 2010, Mid 2011, Mid 2012, Mid 2013, Early 2014, Early 2015)

<p>922-9255 Phillips #000</p>  <p>Trackpad flexure (6)</p>	<p>922-9651 Torx T5</p>  <p>Solid-state drive (SSD) or flash storage (1) AirPort/Bluetooth card or wireless card (1)</p> <p>Late 2010, Mid 2013, Early 2014, Early 2015</p>	<p>922-9685 Pentalobe</p>  <p>Bottom case (8)</p>
<p>922-9686 Pentalobe</p>  <p>Bottom case (2)</p>	<p>922-9688 Torx T8</p>  <p>Display hinge clutch (4)</p>	<p>922-9689 Torx T5</p>  <p>Battery to top case (2)</p>
<p>922-9690 Torx T5</p>  <p>Battery to top case (2)</p>	<p>922-9691 Torx T5</p>  <p>Fan, long (2)</p>	<p>922-9692 Torx T5</p>  <p>Fan, short (1) Logic board (3) I/O board (1)</p>

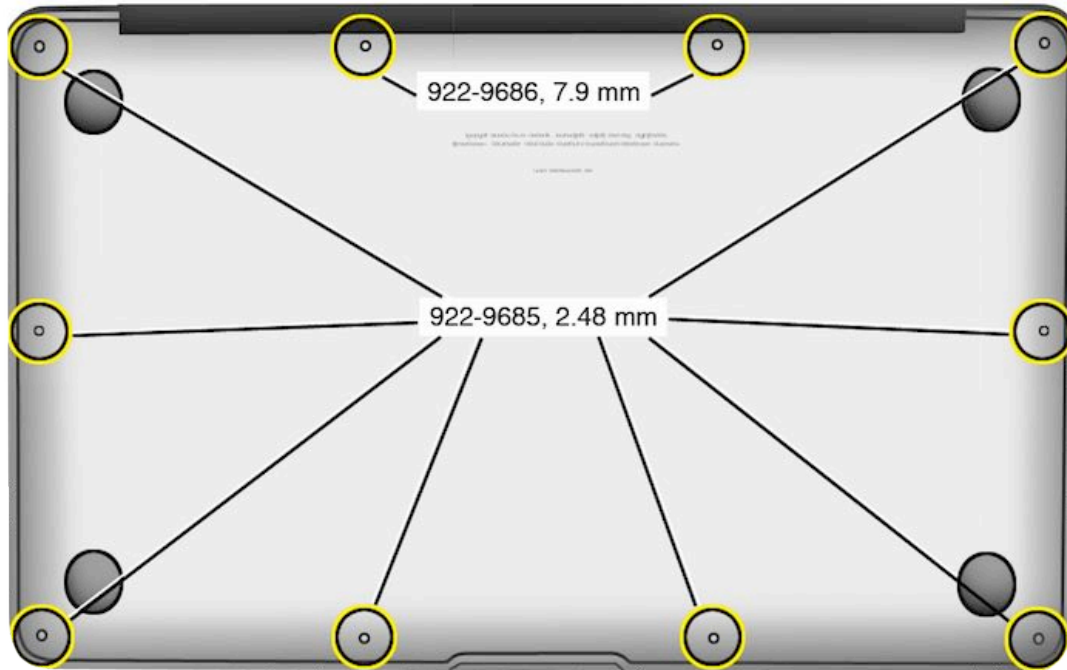
<p>922-9693 Torx T5</p>  <p>Battery to top case (1)</p>	<p>922-9694 Torx T5</p>  <p>Heat sink</p> <p>Mid 2010 (8)</p> <p>Mid 2011, Mid 2012, Mid 2013, Early 2014 (4)</p>	<p>922-9732 Torx T5</p>  <p>Trackpad set screw (1)</p>
<p>923-0025 Torx T5</p>  <p>AirPort/Bluetooth card (1)</p> <p>Mid 2011 and Mid 2012</p>	<p>923-00501 Torx T5</p>  <p>Heat sink (4)</p> <p>Early 2015</p>	

Screw Location Diagrams

Screw Location Diagrams for MacBook Air (11-inch, Late 2010, Mid 2011, Mid 2012, Mid 2013, Early 2014, Early 2015)

Bottom Case

All screw sizes shown are approximate and represent the total length of the screw.



Battery, AirPort/Bluetooth or Wireless Card, SSD Card or Flash Storage

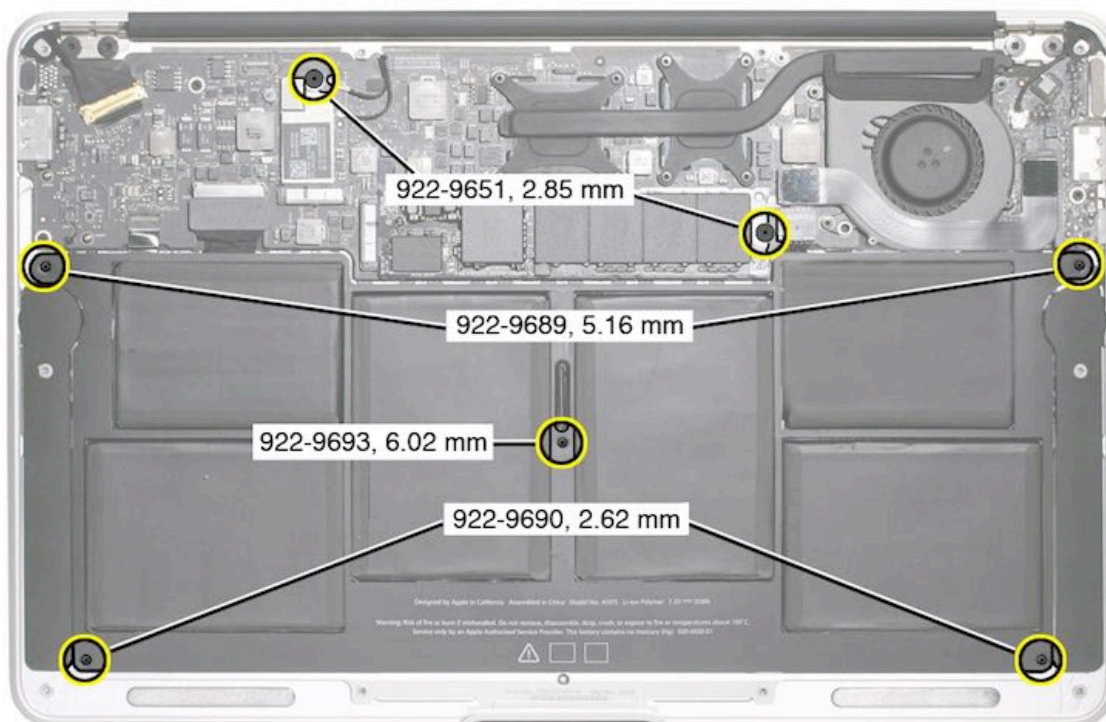
All screw sizes shown are approximate and represent the total length of the screw.



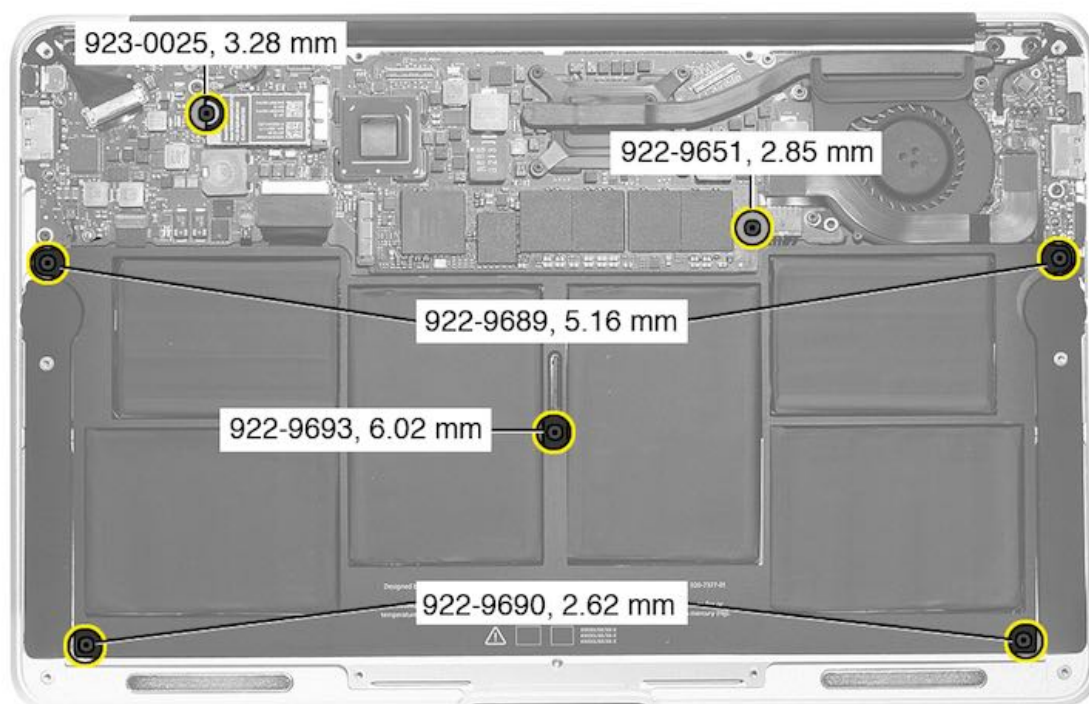
Important: Always attach the battery cover immediately after removing the bottom case, before beginning battery removal.

Caution: Read [Battery Safety Precautions](#) before removing screws.

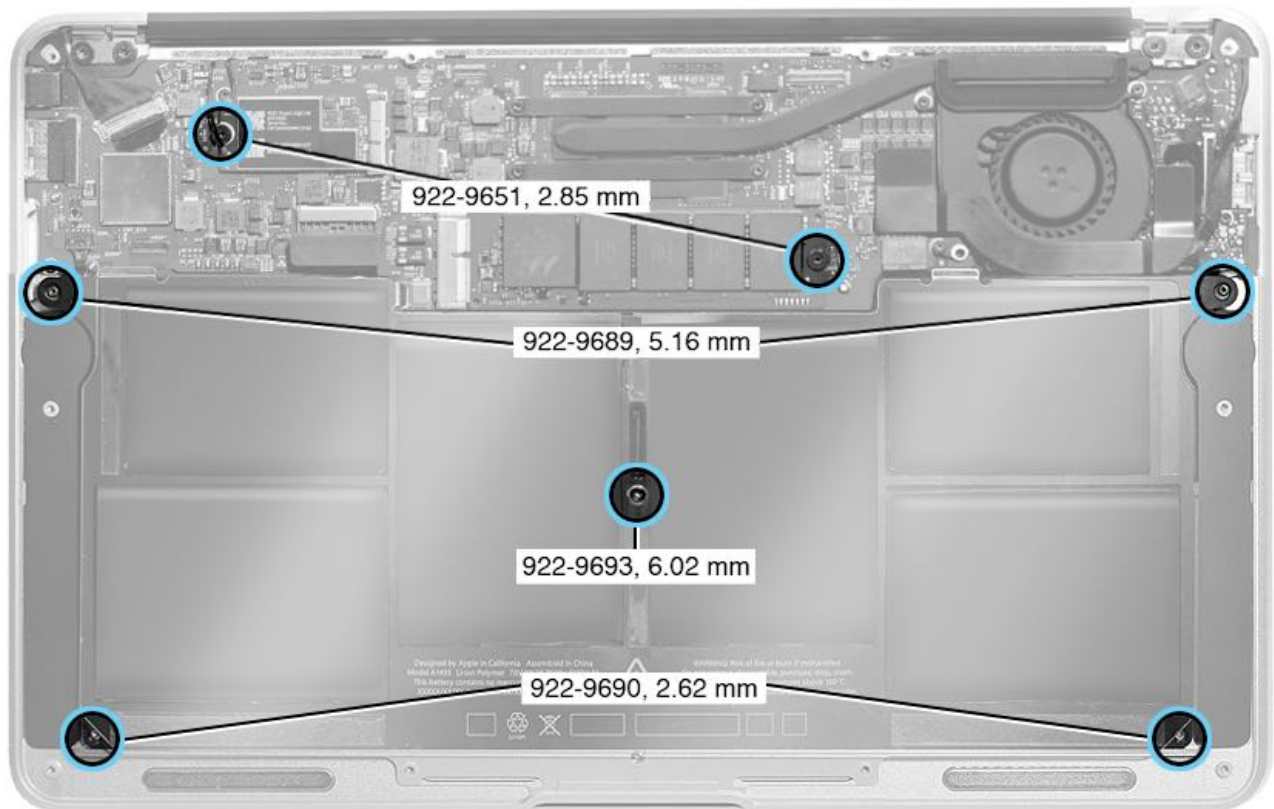
Late 2010



Mid 2011 and Mid 2012



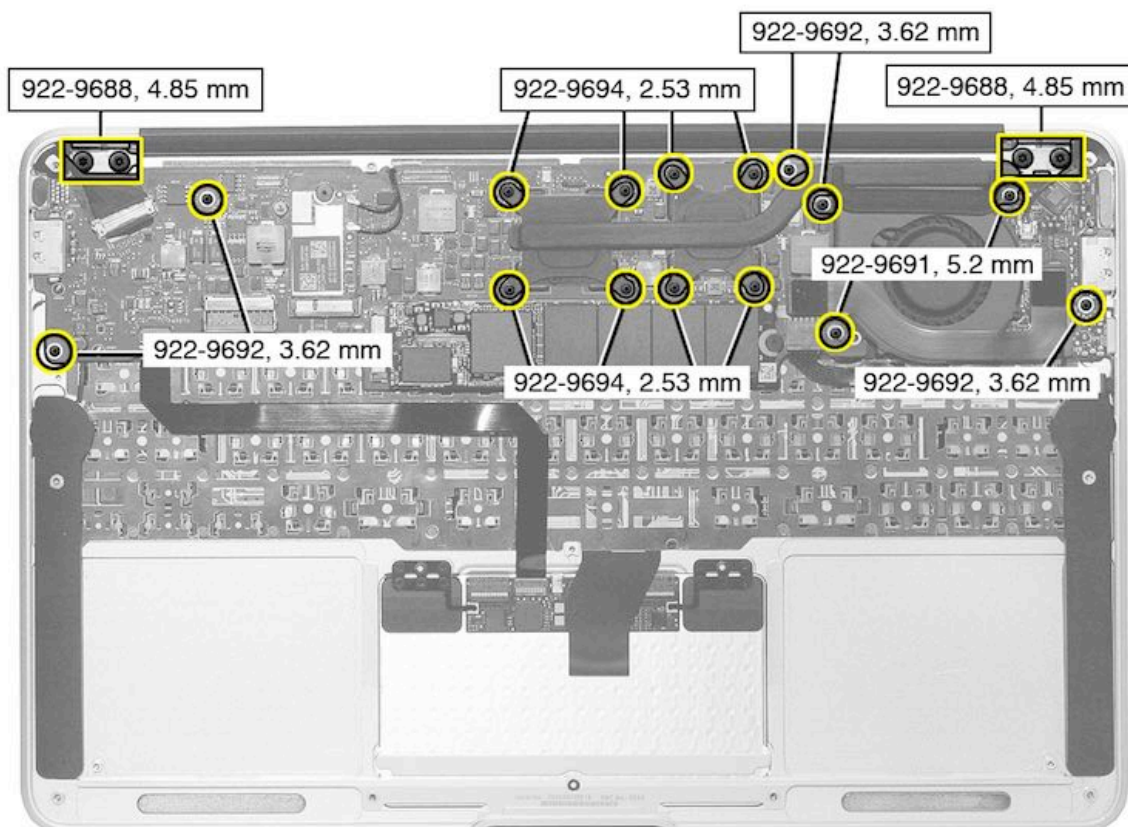
Mid 2013, Early 2014, and Early 2015



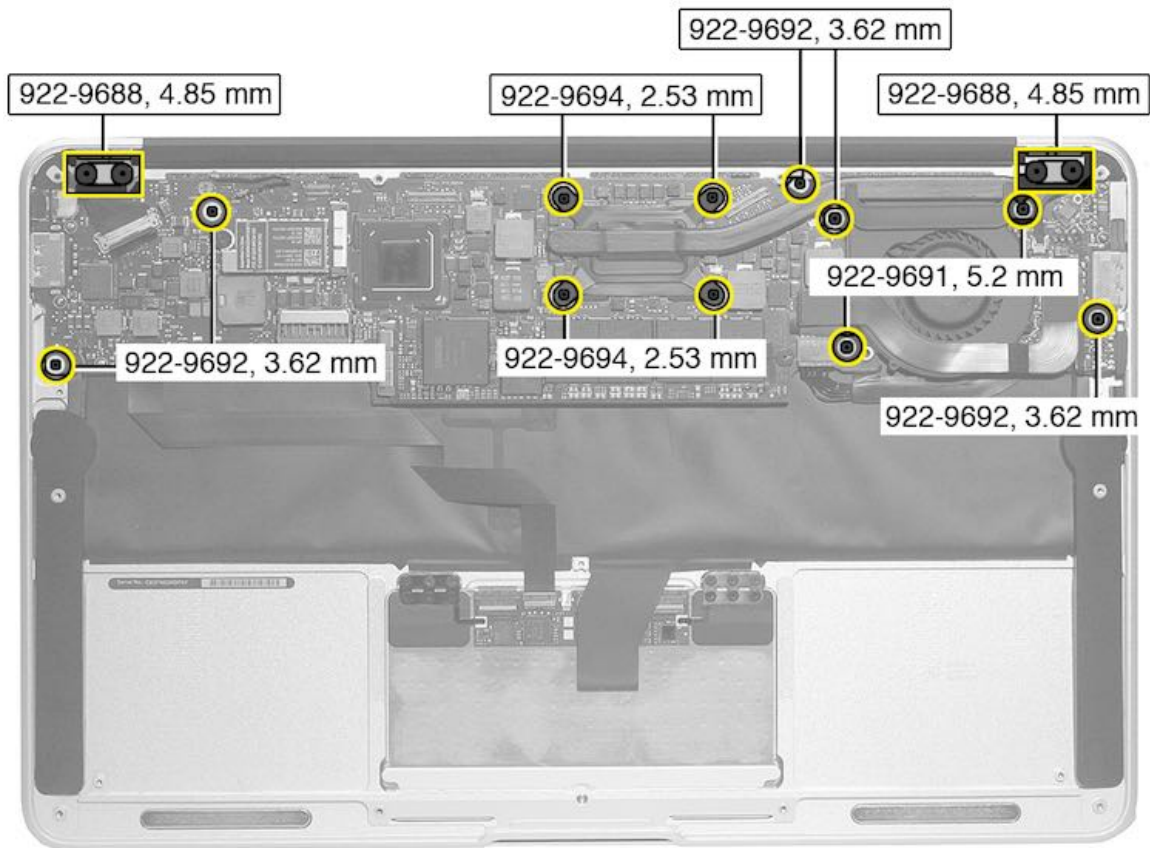
Fan, I/O Board, Heat Sink, Logic Board, Display Clamshell

All screw sizes shown are approximate and represent the total length of the screw.

Late 2010

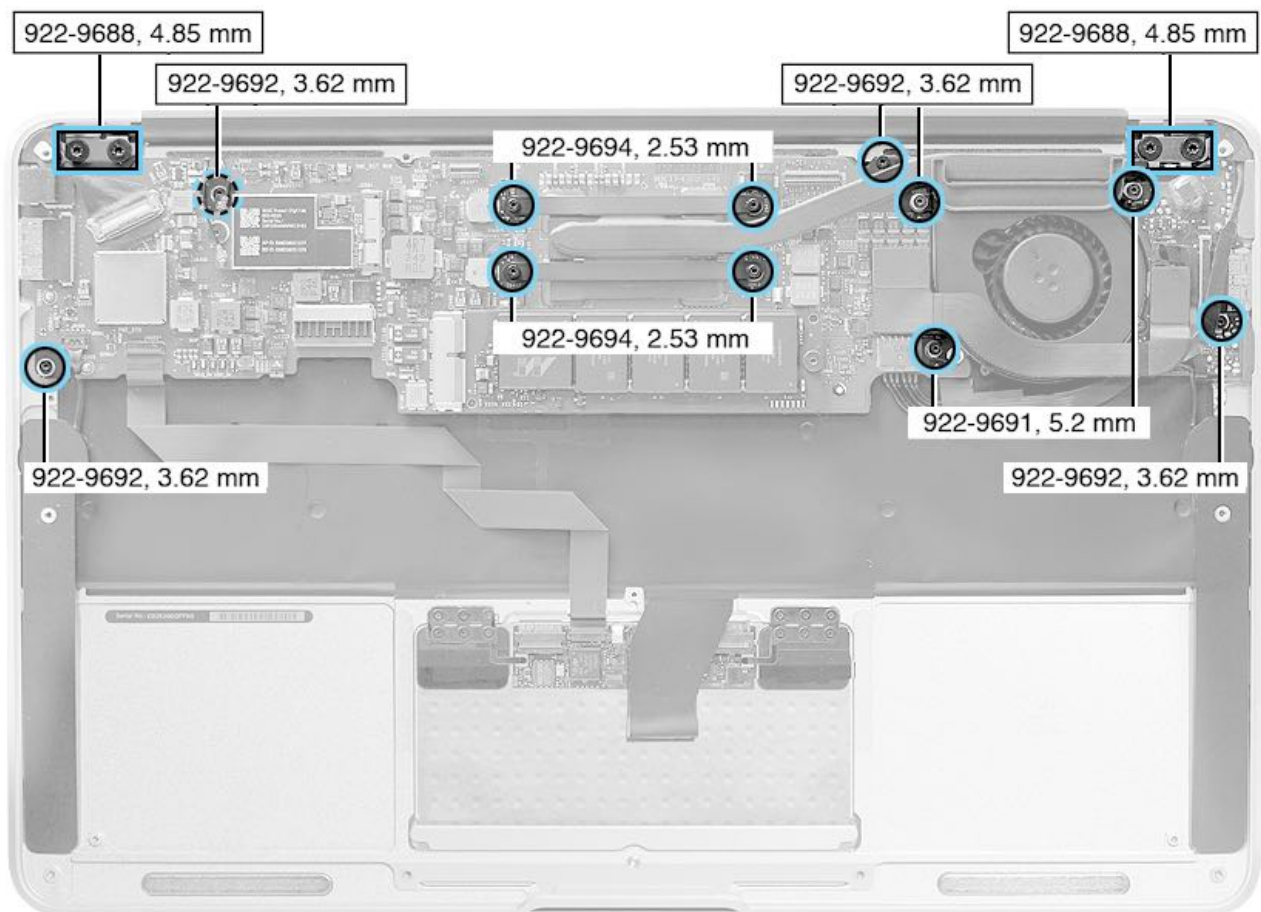


Mid 2011 and Mid 2012



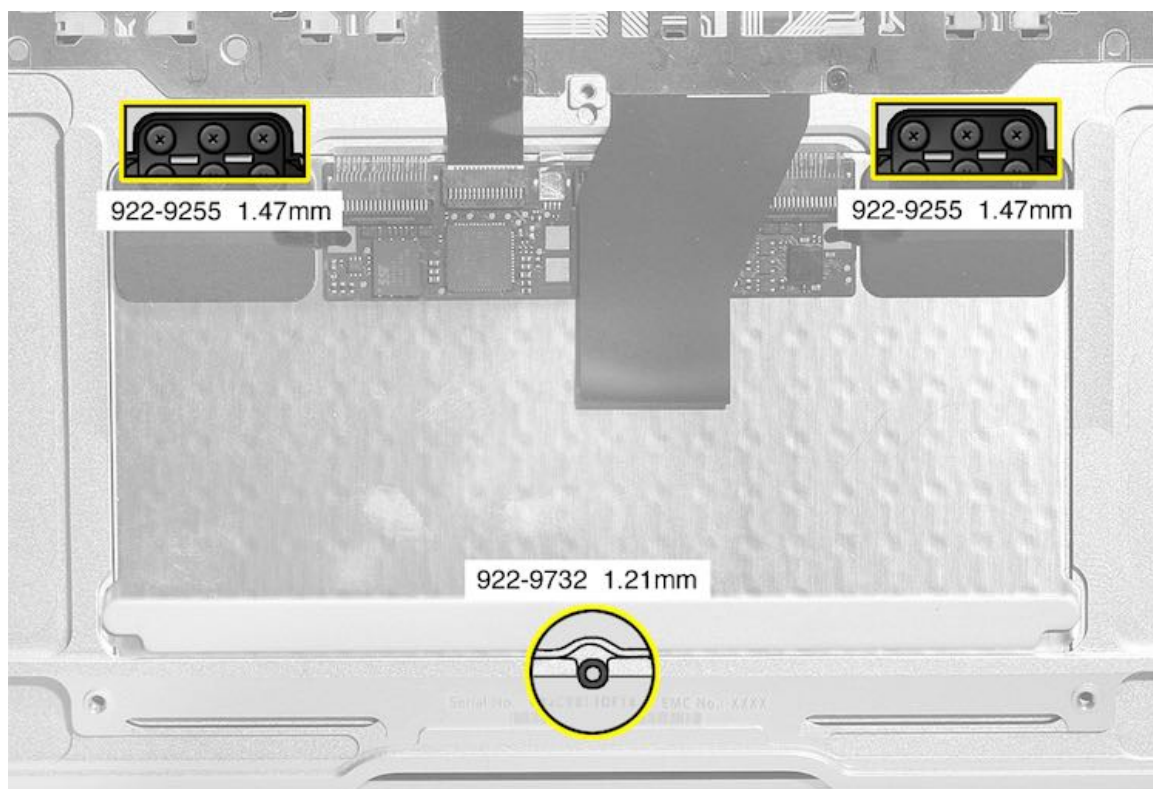
Mid 2013, Early 2014, and Early 2015

Note: MacBook Air (11-inch, Early 2015) heat sink screws are 923-00501.



Trackpad

All screw sizes shown are approximate and represent the total length of the screw.



External Views

Front View

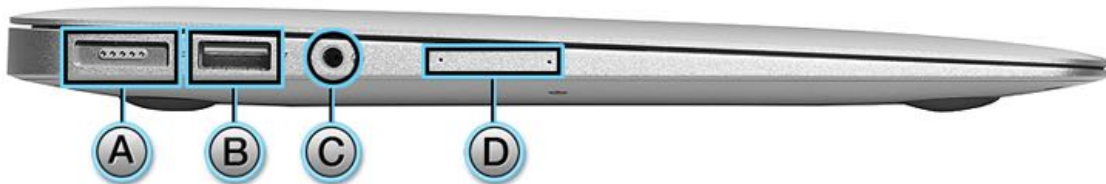


Port Views

Late 2010, Mid 2011, and Mid 2012



Mid 2013, Early 2014, and Early 2015



Late 2010



Mid 2011, Mid 2012, Mid 2013, Early 2014, Early 2015



A = MagSafe (Late 2010 and Mid 2011) and MagSafe 2 (Mid 2012, Mid 2013, Early 2014, Early 2015)

B = USB 2.0 (Late 2010 and Mid 2011) and USB 3 (Mid 2012, Mid 2013, Early 2014, Early 2015)

C = Headphone (audio out)

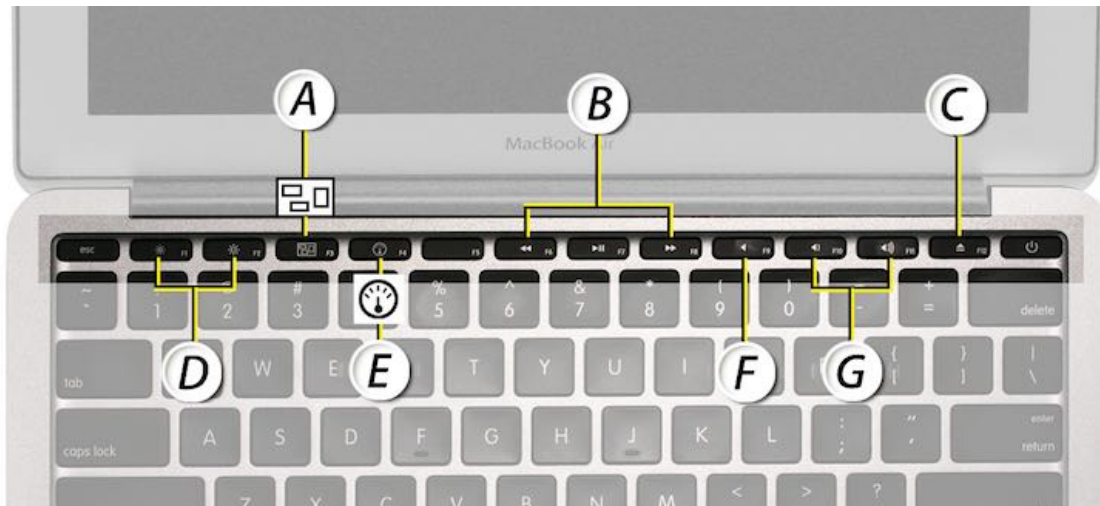
D = Microphone

E = USB 2.0 (Late 2010 and Mid 2011) and USB 3 (Mid 2012, Mid 2013, Early 2014, Early 2015)

F = Mini DisplayPort (Late 2010); Thunderbolt (Mid 2011, Mid 2012, Mid 2013, Early 2014); Thunderbolt 2 (Early 2015)

Function Key Views

Late 2010



A = Expose Key

B= Media Keys

C= Media Eject key

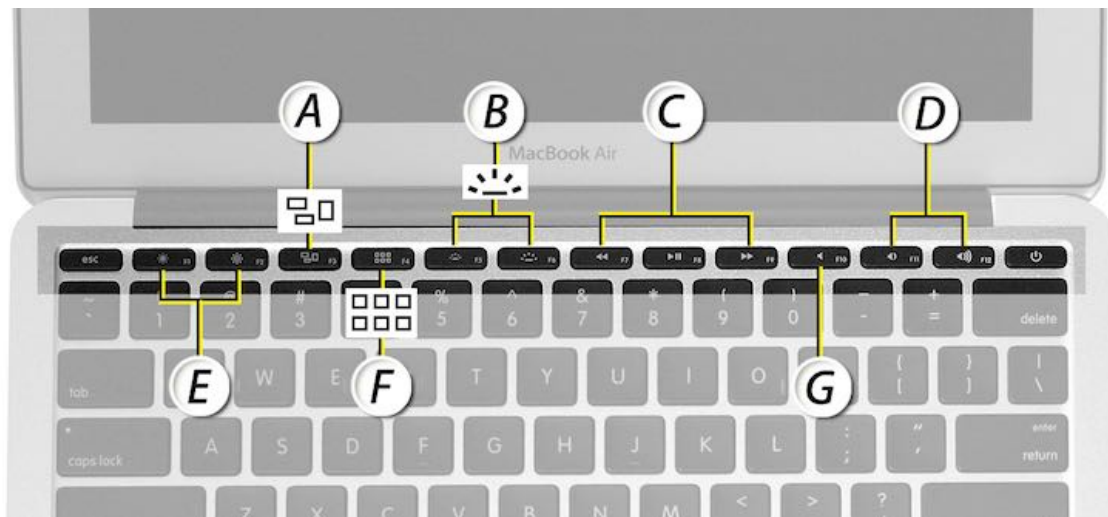
D = Brightness keys

E = Dashboard key

F = Mute key

G = Volume keys

Mid 2011, Mid 2012, Mid 2013, Early 2014, Early 2015



A = Mission Control key

B = Keyboard illumination keys

C = Media keys

D = Volume keys

E = Brightness keys

F = Launchpad key

G = Mute key

MagSafe 2 45W Power Adapter

MagSafe 2 Power Adapter

The MacBook Air (11-inch and 13-inch, Mid 2012, Mid 2013, Early 2014, Early 2015) and MacBook Air (13-inch, 2017) feature a 45W MagSafe 2 power adapter. The MagSafe 2 connector is different from the MacBook Air (Late 2010 and Mid 2011) MagSafe connector. The MagSafe 2 power adapter is not backward compatible.

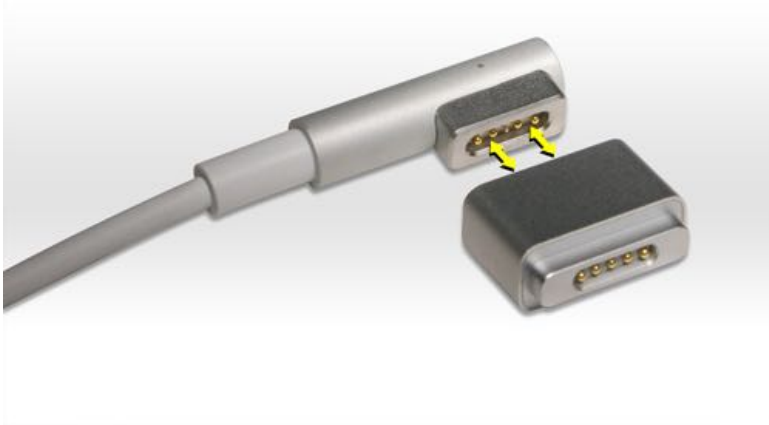


MagSafe 2 Power Connector



MagSafe to MagSafe 2 Converter

The MagSafe to MagSafe 2 Converter allows you to use the MagSafe connector on your LED Cinema Display, Thunderbolt Display, or MagSafe Power Adapter to charge your MagSafe 2-equipped Mac computer.



MagSafe 2 and MagSafe Port Comparison

The image below shows the difference between the MacBook Air (11-inch and 13-inch, Mid 2012 and later) MagSafe 2 port and the MagSafe port on the MacBook Pro (second image).



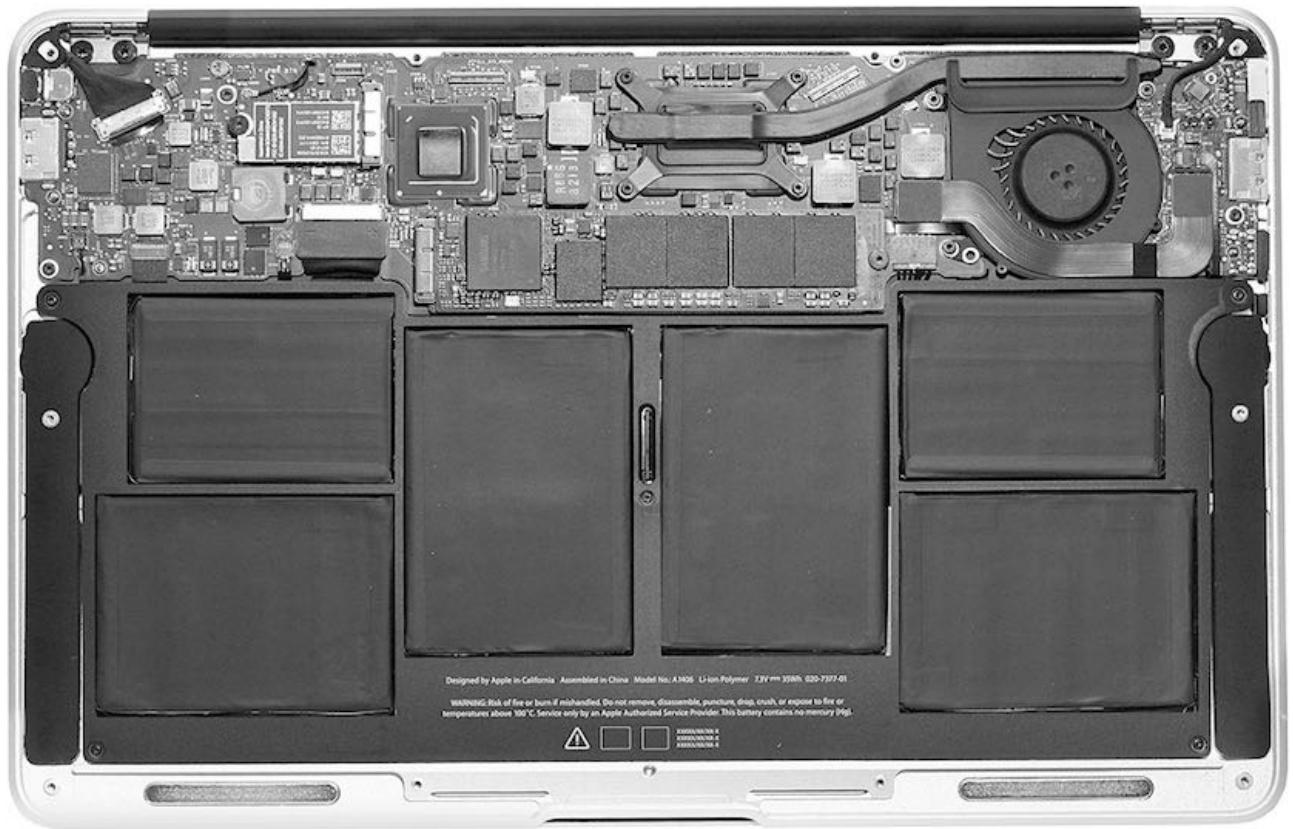
Internal Views

Internal Views of MacBook Air (11-inch, Late 2010, Mid 2011, Mid 2012, Mid 2013, Early 2014, Early 2015)

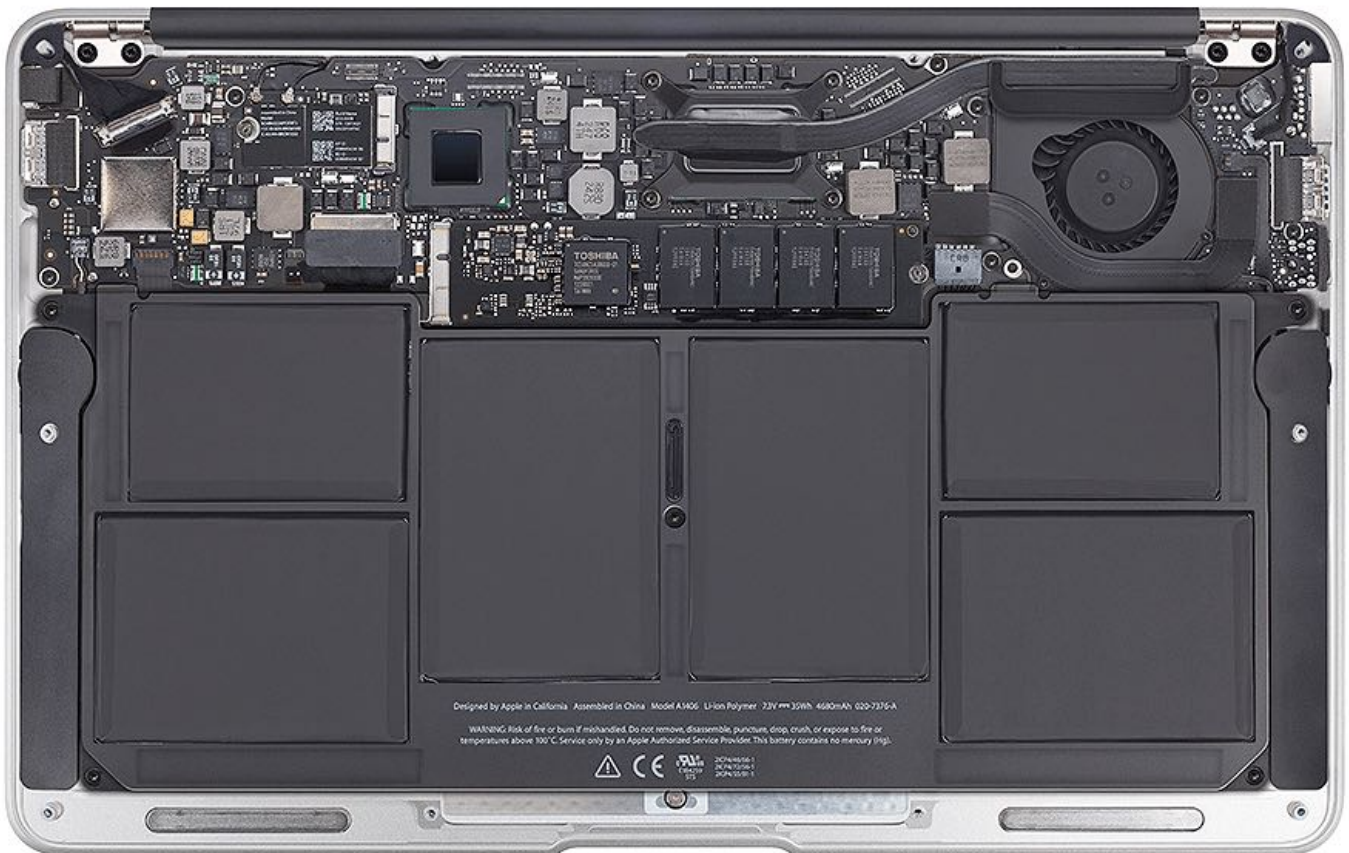
Bottom Case Removed, Late 2010



Bottom Case Removed, Mid 2011



Bottom Case Removed, Mid 2012

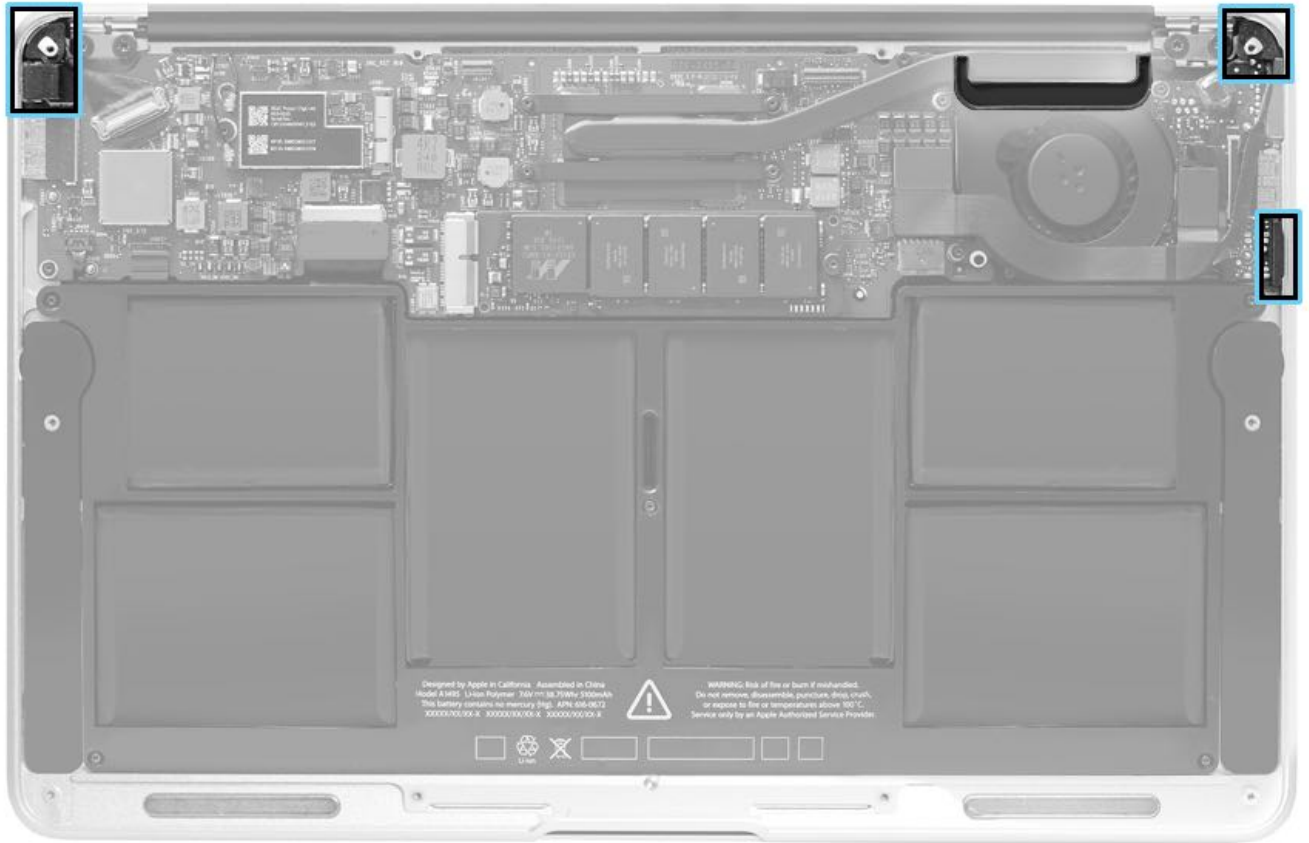


Bottom Case Removed, Mid 2013, Early 2014, and Early 2015

Before completing a repair, make sure the following parts are attached:

- Foam pad over Thunderbolt port
- Display cable holder (rubber gasket)

- Fan gasket
- Camera cable holder (rubber gasket)
- I/O board foam strip over headphone port



Service Content Feedback

This escalation path is intended only for content issues with articles that begin with the prefixes listed below.

Article prefix	Escalate to
IT	itsflows@group.apple.com
OP, RP, SD, SM, TP	serviceguides@group.apple.com
SV	servicevideos@group.apple.com

Please provide a clear and concise description of the content issue you encountered and steps to reproduce. Other information that helps us help you:

- Article number(s) and titles
- Serial number(s)
- Screenshots or screen recording

Note: You may not receive a response, but all comments will be reviewed and investigated as needed.